VETERINARY MEDICINE LIBRARY

OHIO STATE UNIVERSITY
APR 23 1958
LIBRARY

THE JOURNAL OF THE BRITISH VETERINARY ASSOCIATION

The Veterinary Record

PATRON: HER MAJESTY THE QUEEN

Vol. 70 No. 13 Issue No. 4173 271-292

March 29th 1958

The ARMOUR RANGE of VETERINARY PRODUCTS

ADRENOMONE the original long-acting ACTH in Gelatin, for Ketosis in Dairy Cattle and for small animal practice.

FANTOMAR and FANTOMAR FORTE TABLETS containing Dienoestrol and Phenobarbitone for Pruritus Vulvæ and Kraurosis Vulvæ, Phantom Pregnancy and Inhibition of Lactation, Metritis and Pyometra.

P.O.P. purified oxytocic principle for Precipitation of Labour, Postpartum evacuation of Uterine Debris, Retained Placenta, Uterine prolapse, Milk Ejection and Mastitis.

TRYPTAR Purified Crystalline Trypsin for debridement of Necrotic Tissue in surface ulcers, soft tissue Abscesses, Foot Rot, Suppurative Bursitis, Purulent and Gangrenous Mastitis.

STILBOESTROL DIPROPIONATE - B. Vet. C.

Literature from sole distributor in the U.K.

GIMBER
ESTABLISHED 1877

W. GIMBER & SONS LTD., 2, QUEENS ROAD, PECKHAM, LONDON
Telephone : NEW Cross 0438-9

The
VETERINARY RECORD

Founded by William Hunting, F.R.C.V.S., in 1888

7, MANSFIELD STREET, PORTLAND PLACE, LONDON, W.1. MUSEUM 6541

No. 13 MARCH 29th, 1958 Vol. 70

Registered for Transmission as a Newspaper *Price 2s. post free*

A Highly Infectious Gastro-enteritis of Pigs

BY

R. F. W. GOODWIN and A. R. JENNINGS

School of Veterinary Medicine, University of Cambridge

SUMMARY.—An account is given of a highly infectious gastro-enteritis of pigs that appears to be identical with the Transmissible Gastro-enteritis described in the United States.

Introduction

IN a previous communication (Goodwin & Jennings, 1958), attention was drawn to an infectious disease of pigs causing high mortality among young piglets. This disease is now widely distributed, is spreading, and has become a serious problem in some areas. The purpose of this article is to outline the main clinical and pathological features of the condition; a more detailed account, together with a description of transmission experiments, will be published elsewhere.

Clinical Features

Nine major outbreaks have now been investigated. In these, a total of 123 unweaned litters has so far been affected and about 530 piglets have died.

The main clinical sign in pigs of all ages has been a profuse, watery diarrhoea, which in sows and store pigs may be preceded by a short period of anorexia. Rarely has the temperature been raised above normal. Exceptionally, vomiting has occurred in adult pigs but this has been more common among piglets. Young pigs, less than 3 weeks old, were most severely affected and it is in this age group that almost all deaths have occurred. The mortality has been highest during the first week of life, and in litters infected shortly after birth usually all the piglets have died. In older pigs, however, from weaning onwards, mortality has been negligible and most animals have recovered within a week.

A striking characteristic of the disease is its high infectivity. Thus in most instances the condition has spread very rapidly throughout the herd, largely by indirect contact. The incubation period is short and has varied from less than 2 days in the new-born to about 4 days in older pigs. In two herds, however, the disease appeared to be confined to the sucking pigs, although the mortality in this age group was still high. Once the disease has appeared in a herd it has been very difficult, by isolation and disinfection, to prevent it from spreading. To illustrate both the acuteness and the infectivity of this form of gastro-enteritis, in one fattening house 96 fattening pigs all developed profuse diarrhoea within a period of about 36 hours, 3 days after the first signs of the disease had appeared on the farm.

Gross Pathology

Seventy-five piglets from these outbreaks have been examined *post mortem* in the laboratory. The most common findings have been varying degrees of gastro-enteritis. In piglets dying during the first few days of life, the stomach has shown very little change beyond a few pin-point haemorrhages near the pylorus. In older piglets the gastritis has been more severe and there has occasionally been ulceration. Although the gastritis has sometimes been evident from the serous surface, in other cases it was essential to wash out the stringy curd in order to see this. The gastric mucosa has often been covered by a grey fibrinous deposit, beneath which small haemorrhages or pin-point ulcers were sometimes found. In 3- to 4-week-old piglets the gastric erosions may be several centimetres in diameter.

The intestinal changes have likewise varied with

the age of the piglet. In the very young pig the jejunum has been ballooned with gas and the terminal part of the small intestine has usually shown only a catarrhal inflammation. In the older piglet, however, the enteritis has been more severe and often haemorrhagic; in the latter cases the gut contents may be pink due to the presence of blood. Otherwise, the contents are commonly yellowish-green in colour.

Another frequent finding has been acute meningeal congestion with small haemorrhages in the meninges and, less commonly, at the base of the cerebellum. There has also been excess cerebro-spinal fluid, so that the cerebral convolutions appear flattened and moist. Petechial haemorrhages have occurred elsewhere in the body and the sites, in order of frequency, have been: kidneys, spleen, lymph nodes, larynx and, rarely, the bladder. Invariably, the mesenteric and gastric vessels have been acutely congested.

Transmission

The disease has been reproduced experimentally on three occasions by direct contact, infected piglets from a field outbreak being mixed with normal litters at Cambridge. It has also been reproduced inadvertently by indirect contact on two separate occasions. Furthermore, enteritis has been induced in two more litters with the supernatant fluid from a centrifuged suspension of gut and brain, or gut alone, given by mouth. A filtrate given by mouth to colostrum-free store pigs, which had subsequently been reared in rigid isolation, produced profuse diarrhoea with anorexia. This filtrate had been passed through a gradocol membrane (A.P.D. 0.81 μ).

More recently, the disease has been transmitted on three occasions using material that had passed through finer filters (gradocol membranes, A.P.D. 0.32 μ).

Discussion

As the disease affected pigs of all ages, was highly infective, caused enteritis and rapidly killed new-born piglets, the possibility of swine fever was considered during the investigation of the first outbreak. Some of the lesions, particularly the acute haemorrhagic changes observed in older piglets, were similar to those seen in swine fever. Furthermore, histological examination of three of these older pigs indicated slight meningo-encephalitis, as is also seen in swine fever. The laboratory examination of individual dead piglets, therefore, unaccompanied by a detailed clinical history, could lead to a diagnosis of swine fever. Clinically, a typical outbreak differs from swine fever in that the disease has been as severe in pigs that have been vaccinated against swine fever as in non-vaccinated animals. Secondly, non-vaccinated pigs over about 3 weeks of age have almost invariably recovered. Thirdly, there is seldom pyrexia as in swine fever and, fourthly, nervous signs are rarely seen. In addition, the incubation period is much shorter. Nevertheless, in the first outbreak, pancreases from a number of dead piglets were submitted to the Central Veterinary Laboratory, Weybridge, for the gel-diffusion precipitin test. All these tests were negative for swine fever.

Aujeszky's disease can also cause heavy mortality among new-born pigs. In the outbreak described by Gordon & Luke (1955), however, the main signs in older pigs included severe constipation and obvious inco-ordination progressing to paralysis. In addition, pregnant sows aborted or produced mummified foetuses; a syndrome not seen in outbreaks of gastro-enteritis. So far, histological examination of our material, and the inoculation of piglets, rabbits and embryonated eggs have shown no evidence of Aujeszky's disease.

The disease that we have described appears to be identical with the Transmissible Gastro-enteritis in the United States (Doyle & Hutchings, 1946). The latter disease is characterised by a short incubation period, very high infectivity, profuse diarrhoea at all ages, a high mortality rate below about 3 weeks of age, and *post-mortem* findings of acute gastro-enteritis. As with the American disease, antibiotics and other drugs have failed to influence the course of the present outbreaks. Work is now in progress on the relationship between these two diseases and on methods of control.

Acknowledgments.—We are grateful to Miss E. A. Robb and Mr. P. J. D. V. Brett for technical assistance. Dr. A. J. Wilsdon arranged for the pancreas tests to be carried out with the co-operation of the Central Veterinary Laboratory. This work was assisted financially by a general grant to one of us (R. F. W. G.) from the Agricultural Research Council.

References

DOYLE, L. P., & HUTCHINGS, L. M. (1946). *J. Amer. vet. med. Ass.* **108.** 257.
GOODWIN, R. F. W., & JENNINGS, A. R. (1958). *Vet. Rec.* **70.** 111.
GORDON, W. A. M., & LUKE, D. (1955). *Ibid.* **67.** 591.

MORE VETERINARY SURGEONS ON RACE-COURSES

It is reported in the press that three veterinary surgeons instead of two will ensure that every horse is fit to run at future race meetings. Stewards of the Jockey Club have ordered race-course executives to employ an additional veterinary surgeon for the flat-racing season which has just opened.

He will be present at the start of each race, to make sure that each horse is fit to run, and also to act as a last-minute check against "nobbling."

Up to now, two veterinary officers have been on duty in the paddock. But there have been instances of a horse being found lame on reaching the starting gate, with no one on hand to give an expert opinion whether it was fit to run.

The Anthelmintic Activity of Dithiocarbamates against Ascaridia and Nematodirus

BY

J. W. G. LEIPER

Boots Pure Drug Co. Ltd. Nottingham

SUMMARY.—Tests with dithiocarbamates and related compounds show that n-*butyl* N-*phenyldithiocarbamate is outstanding in anthelmintic activity against* Ascaridia galli *in chickens and* 3 *common Nematodirus species in sheep. Data is presented of the preliminary results consisting of critical tests, comparative* post-mortem *worm counts, and egg counts. This demonstrated the efficiency of this compound against Nematodirus in* 25 *lambs during the spring of* 1957 *using dosage rates of* 50 *to* 500 *mg. per kg.*

It is recommended that this anthelmintic be administered at 100 *mg. per kg. alone or together with phenothiazine during the first half of May to control Nematodirus and the other common nematodes of lambs. A second dose may be given* 3 *to* 4 *weeks later and this will then tide the lamb over the period of nematodirus susceptibility.*

THE helminth parasites of our domesticated animals are still of great economic importance, the advent in recent years of synthetic anthelmintics such as chlorinated hydrocarbons, phenothiazine, and the piperazines has given us remedies far superior to the medicaments derived from the vegetable kingdom and used for centuries past. However, there still remain many species of helminth parasites for which there is no satisfactory remedy, in fact one might go further and say that by controlling certain parasites through routine medication, others not previously considered to be of pathogenic importance flourish and may assume economic proportions. The ideal anthelmintic is one which while being of low toxicity to the host animal will eliminate all species of helminths capable of parasitising the host. Until such a one is forthcoming one has to be content with an anthelmintic or combination of anthelmintics that cover as wide a spectrum as possible.

In order to test large numbers of drugs for nematicidal properties, using only small quantities of each drug, the author has for a number of years used as an *in vitro* screen the vinegar eelworm (*Turbatrix aceti*) (Leiper, 1952). A 4-times serial dilution of drug in a culture of this free-living nematode is set up using drug concentrations of 0.5 per cent. down to 0.0005 per cent. If after incubation at 36° C. for 48 hours a 100 per cent. kill has occurred at a 0.031 per cent. concentration or less, *in vivo* tests are carried out in chickens infested with *Ascaridia galli* and *Heterakis gallinae*. Promising drugs are then tried in sheep, pigs, and dogs carrying infestations which parasitise these animals. One of the most active drugs discovered up to the present is *n*-butyl ester of *N*-phenyldithiocarbamic acid (R.D.976).*

$NHCSS(CH_2)_3CH_3$

A good activity was recorded in the eelworm test —100 per cent. kill at a concentration of 0.002 per cent. and there was an outstanding activity against *Ascaridia galli* when tested in chickens. While work was in progress elucidating the value of this compound, the author's attention was drawn to a paper by Rawson, Ferrall, Reynolds, and Mayer (1955) on the activity of thionocarbanilates against mouse pin worm. Thirty-six compounds were tested by these workers, and it was concluded that N-butyl-p-allyloxy-thionocarbanilate was outstanding in its activity, but the results with *N*-butyl phenyldithiocarbamate were nearly as good as those obtained with the above thiono compound. These authors considered, however, that the dithiocarbamates, while showing interesting oxyuricidal activity, were unsuited for clinical use because of the pronounced and penetrating garlic-like odour. In veterinary therapeutics this latter objection is not so important, the primary concern is efficiency, safety, and economy. The present author therefore continued his work of evaluating the anthelmintic properties of dithiocarbamates and related compounds in domesticated animals.

Critical Tests in Chickens

Chickens infested with *Heterakis gallinae* and *Ascaridia galli* were placed in individual battery cages and 3 days later were weighed and dosed with weighed amounts of the drug to be tested which was administered in gelatine capsule by mouth. All the faeces from the individual dropping boards were collected each day for 4 days, and after screening the worms voided were picked out, sexed, and counted. Seven days after dosing the chickens were weighed, killed, and post-mortem worm counts carried out.

The activity of R.D.976 against *Ascaridia galli* is given in Table I. It will be seen that activity has been 100 per cent. with all chickens receiving more than 72 mg. per kg. R.D.976, and even at lower dose rates a high degree of activity has been recorded. There was, however, no activity against *Heterakis gallinae*. A dose rate of 1,170 mg. per kg. was lethal to one chicken, but rates of 840 mg. per kg. and less were well tolerated.

Compounds Related to R.D.976

A total of 60 other dithiocarbamates were tested in chickens but none showed activity as great as R.D.976. With most of these compounds activity was considerably reduced or totally lost. It is

TABLE I

CRITICAL TESTS AGAINST *Ascaridia* IN CHICKENS WITH R.D.976

Dose rate mg. per kg.	Worms voided	Worms remaining	Per cent. efficiency	Remarks
14½	2	7	22	
15	5	8	38	
21	2	0	100	
22	1	3	25	
23	3	0	100	
48	5	0	100	
48	1	4	20	
55	4	2	67	
57	93	16	85	
70	2	2	50	
72	6	1	86	
74	20	0	100	
84	2	0	100	
96	2	0	100	
97	8	0	100	
122	10	0	100	
125	35	0	100	
153	15	0	100	
162	16	0	100	
204	18	0	100	
295	15	0	100	
410	7	0	100	
840	12	0	100	
1,170	6	0	100	Died 4th day

unnecessary for the purpose of this paper to go into details of the relative efficiencies of all these compounds, let it suffice to summarise the activity of the more closely related compounds. Of the other esters of *N*-phenyldithiocarbamic acid, the methyl showed no activity, ethyl, propyl, and amyl showed good activity but not as good as the butyl; the hexyl, heptyl, and octyl showed little or no activity. Para substitution in the phenyl for instance with fluorine, chlorine, or a nitro group caused retention of activity, but a bromo, iodo, or methoxy group reduced activity. Substitution of the hydrogen on the nitrogen with a methyl or ethyl group knocked out activity, but activity was retained when the phenyl group was replaced by a *cyclo*hexyl group.

All these dithiocarbamates have a rather unpleasant smell and it is considered that this is due to the inherent property of these compounds to form very small amounts of mercaptan. When this evaporates off into the air more is formed to take its place and an equilibrium is slowly reached again. In order to try to overcome this smell one or both of the sulphur atoms was replaced by oxygen which on dissociation would yield an alcohol or phenol instead of a mercaptan. Where both sulphur compounds were replaced the resulting carbamates were practically inactive against Ascaridia, but where one sulphur only was replaced by oxygen the thioncarbamates formed still retain some degree of activity; butyl *N*-phenylthioncarbamate was the best of this type of compound so far tested and was about half as active as the corresponding dithiocarbamate compound R.D.976.

Tests in Sheep with R.D.976

Critical tests in sheep are not easy to carry out. Because of the long length of the alimentary canal, parasites voided are in a poor state of preservation especially parasites of the abomasum and small intestine, also worms of the genus Nematodirus are well known to disintegrate readily under the best of circumstances and this occurs even more readily after medication with an anthelmintic. Two critical tests were carried out in housed lambs carrying naturally acquired infestation using R.D.976. The two lambs were given this compound as a drench suspended in water with Dispersol L.N., and a high degree of activity was demonstrated against nematodes of the genus Nematodirus; a few strongyloides, Cooperia, and other common trichostrongyles were also voided but large numbers of these latter genera were present on *post mortem*, thereafter attention was concentrated on evaluating this compound as an anthelmintic against Nematodirus species. *N. battus*, *N. filicollis*, and *N. spathiger* were passed out but the specimens were in many cases too disintegrated to give a species diagnosis. Table II gives Nematodirus egg counts before and after treatment, and the worms passed out during the 48 hours following medication. It will be seen that in these comparatively large lambs carrying a low Nematodirus burden the drug was 100 per cent. efficient at a dose rate of 100 and 250 mg. per kg. The greatest number of worms were passed out between 16 and 36 hours after medication.

Table III gives the results of egg counts before and after treatment of two lambs and one control lamb followed up by *post-mortem* Nematodirus worm counts 5 days later. Infestations were heavy and although an estimated 5,400 Nematodirus were present at *post mortem* in the lamb dosed at 100 mg. per kg., over one-third of these were immature stages; of the adults only about one-sixth were females and very few of these were found to contain eggs.

Table IV gives the Nematodirus egg counts in two small groups of grazing lambs containing undosed lambs and lambs dosed at varying rates. Medication with R.D.976 at a dose rate of 100 mg. per kg. up to 500 mg. per kg. caused a sudden drop in egg count which remained at a low figure for about 2 weeks and then rose to a lower peak 4 or 5 weeks later.

The result of another small trial in grazing lambs

TABLE II

CRITICAL TESTS WITH R.D.976 AGAINST NEMATODIRUS IN LAMBS

Sheep number	Weight lb.	Dose rate mg. per kg.	E.P.G. 0 hours	Worms voided					Worms at *post mortem*
				16 hours	24 hours	36 hours	48 hours	62 hours	
408	78	100	1,150	40	3,050	130	5	0	0
6	75	250	200	0	216	320	20	0	0

TABLE III

EVALUATION OF ACTIVITY OF R.D.976 IN LAMBS IN COMPARISON WITH CONTROLS OF EGG COUNTS AND *Post-mortem* WORM COUNTS DOSED 10.5.57

Sheep number	Weight lb.	Dose rate mg. per kg.	Nematodirus E.P.G. 7.5.57	10.5.57	13.5.57	15.5.57
7	58	Control	1,700	750	500	400
8	70	100	3,200	1,450	0	0
4	73	250	2,050	1,150	0	0

	Sheep No. 7 control	Sheep No. 8 100 mg. per kg.	Sheep No. 4 250 mg. per kg.
Nematodirus battus ♂ ...	3,500	200	400
,, ,, ♀ ...	2,500	0	200
Nematodirus other sp. ♂ ...	8,500	2,200	550
,, ,, ♀ ...	11,500	500	50
,, ? sp. ...	1,000	500	50
,, young adults	1,000	2,000	300
Total	28,000	5,400	1,550

is given in Table V. Because R.D.976 does not appear to be effective against other trichostrongyles a mixed drench was made. Two fluid ounces contained 10 grammes of phenothiazine and 2½ grammes of R.D.976. Results are tabulated giving the effectiveness of this drench against Nematodirus. Two ounces of suspension was given to lambs varying in weight between 35 and 60 lb. It is usual to drench lambs in the spring with phenothiazine and it is obvious that R.D.976 would be best used in conjunction with such an anthelmintic. Dosage rates varied between 93 and 143 mg. per kg. of R.D.976, and results based on egg counts indicate that administration of this formulation controlled Nematodirus infestation for 3 to 4 weeks. Twenty-five further lambs were dosed in Berwickshire with this formulation during May and June of 1957 but Nematodirus infestations were so low that it was not worth while collecting faeces for efficiency data; the lambs, however, tolerated the medication well.

* "Nematodirus compound," Boots Pure Drug Co. Ltd.

It has been convenient for this work that the eggs of Nematodirus are characteristic in being very much larger than the eggs of other strongyles in sheep. Too much reliance, however, cannot be placed on egg counts alone. The evidence from critical tests and the comparison of *post-mortem* worm counts of treated and untreated lambs gives weight to subsequent tests using egg counts as the only criterion of efficiency. The vagary of Nematodirus egg counts is shown in the varying counts over the period of examination of control lambs Nos. 2, 11, and 71 (Table IV). In lamb No. 7 (Table III) 1,700 e.p.g. were recorded at the start of the experiment; this had fallen to 400 e.p.g. 8 days later when it was slaughtered, and on *post mortem* it was found to harbour a total of 28,000 Nematodirus worms! It is the author's conclusion from this work and previous observations that with very heavy Nematodirus infestations there may be a very low egg output which is probably due to a poor nutrition state of the tens of thousands of parasites competing amongst themselves for the available food.

Tests in Sheep with Compounds Related to R.D.976

It was not possible to carry out many *in vivo* tests in sheep with other active compounds similar to R.D.976 but four sheep were dosed with butyl *N*-phenylthioncarbamate (R.D.6429). At 100 mg. per kg. it was not active, but 250 mg. per kg. caused the passage of 1,380 Nematodirus specimens, and 10 days later only 140 were found on *post mortem*; there was also, in this case, activity against Chabertia and Trichuris. A second lamb dosed at 250 mg. per kg. and a lamb given 500 mg. per kg. were negative to Nematodirus prior to dosing, but here again a few of the Chabertia and Trichuris present were voided.

One lamb dosed at 100 mg. per kg. with butyl

TABLE IV

EVALUATION OF R.D.976 BY EGG COUNTS COMPARED WITH CONTROLS IN LAMBS DOSED 10.5.57 OR 16.5.57

Sheep number	Weight lb.	Dose rate	Dosed 10/5/57	Nematodirus E.P.G. on date indicated (1957)									
			7.5	10.5	13.5	15.5	20.5	27.5	3.6	11.6	17.6	24.6	1.7	9.7
						Dosed 10.5.57								
11	41	Control	3,950	850	100	200	0	650	0	750	50	50	450	50
2	51	,,	—	750	0	400	950	50	—	100	500	400	—	100
1	59	100 mg. per kg.	1,300	600	0	0	100	250	250	200	1,050	50	100	100
3	48	150 ,,	850	700	50	0	0	300	150	0	150	50	0	150
9	45	150 ,,	1,400	0	0	50	0	250	100	150	100	150	100	50
10	43	250 ,,	900	400	0	50	0	0	0	200	50	0	0	0
				16.5	20.5	22.5	27.5	3.6	11.6	17.6	21.6	1.7	9.7	15.7
	Dosed 16/5/57													
						Dosed 16.5.57								
96	29	Control ...		1,950	2,650	2,400	2,800	3,850	1,450	1,200	1,300	450	250	200
71	46	,, ...		1,000	400	400	250	400	850	300	900	300	250	400
70	45	50 mg. per kg. ...		1,600	200	0	0	550	350	—	350	—	0	150
97	36	50 ,, ...		1,700	500	300	1,000	1,300	1,000	300	850	0	100	0
95	36	75 ,, ...		2,950	2,300	1,100	1,550	1,300	750	700	850	550	250	150
72	42	500 ,, ...		650	0	0	0	150	500	450	1,000	250	0	100
65	32	500 ,, ...		1,250	450	100	50	0	500	300	0	0	300	0

TABLE V

2 FL. OZ. DRENCH CONSISTING OF 2½ G. R.D.976 AND 10 G. PHENOTHIAZINE ADMINISTERED TO LAMBS 25.5.57

Sheep number	Weight lb.	Dose rate R.D.976	Nematodirus E.P.G. on date indicated						
			25.5	27.5	30.5	6.6	18.6	24.6	3.7
443	—	Control	450	400	300	100	600	200	300
402	—	,,	1,700	1,500	900	600	750	1,850	300
442	60	92 mg. per kg.	450	150	0	0	200	450	300
403	58½	93 ,,	1,500	50	0	0	50	400	200
412	56	98 ,,	950	0	100	0	—	50	250
415	53½	103 ,,	600	50	50	0	50	0	0
404	35	143 ,,	300	150	100	100	0	50	100

*N-cyclo*hexyldithiocarbamate (R.D.6365) passed out 2,720 Nematodirus but 3,600 were found on *post mortem* 6 days later. Further tests will have to be carried out with these compounds but it appears that a higher dosage level is required than is the case with R.D.976.

Discussion

Evidence has been given showing that R.D.976 is effective against Ascaridia in the domestic fowl and Nematodirus in lambs. As regards the fowl it is unlikely that this compound has any advantage over the piperazines, it has the disadvantage of the unpleasant odour and it is not readily taken in the food. For the removal of Nematodirus sp. the compound has shown a specific activity and for this purpose it fills one of the major gaps in the anthelmintic control of roundworms in lambs. Phenothiazine on its own does not control this parasite and as a result farmers in certain districts of Britain recently discontinued the use of this remedy in their young lambs because they believe it encourages Nematodirus infestations, as a result they run the danger of allowing the other nematodes of sheep to build up again on their farms and cause the losses that were widespread before the advent of phenothiazine therapy. A combination of the two anthelmintics should control both Nematodirus and the species susceptible to phenothiazine treatment.

The evaluation of the efficiency of an anthelmintic for the removal of Nematodirus is difficult because of the seasonal incidence of the parasite. While a few parasites may be found in sheep at any time of the year the large numbers that may assume pathogenic proportions occur in Britain only during the month of May and the first half of July. Kingsbury (1953) described a disease in lambs in spring in the border counties characterised by intense scouring, dehydration, and sudden death. Heavy infestations with Nematodirus were present and he attributes the disease to these parasites. Thomas and Stevens (1956) have given the peak of numbers of outbreaks as being about the middle of June, and the season to extend principally from the 3rd week of May to the beginning of July. Stamp, Dunn, and Watt (1955) also give an account of the disease and point out that there is no effective drug for this parasite, but prevention can be accomplished by pasturing lambs on land not grazed by hoggs or lambs the previous year. They consider the contamination of pastures during the previous year by lambs and hoggs is responsible for disease outbreaks during the following spring. Nematodiriasis is now accepted as a disease of lambs not only in the border counties but also in Wales, Northern Ireland, and Sussex. Nematodiriasis has not been recorded from other parts of the world but Kates and Turner (1953) have shown that experimental infestations in lambs in America caused diarrhoea and loss of condition. With regard to anthelmintic treatment there has not been any satisfactory drug up to the present. Kingsbury (1953) reported that hexachlorethane at high dosage levels gave a reduction in egg output by about 50 per cent. and more recently it has been suggested that piperazines are of some value. R.D.976 is outstanding in its anthelmintic property for removal of nematodirus worms but unfortunately owing to the lack of outbreaks during 1957 an opportunity has not yet occurred to test it in lambs showing symptoms of the disease nematodiriasis reported by Kingsbury and other workers.

Recommendations

Medication with R.D.976 at a dose rate of about 100 mg. per kg. will remove 80 to 100 per cent. of Nematodirus sp. and it is recommended that lambs be dosed with this compound during the first half of May when infestations first appear in lambs. To combat reinfestation a further dose 3 to 4 weeks later should be given, this will knock out the secondary peak exemplified in Table IV and should tide the lamb over the period of greatest susceptibility. Such a routine medication will prevent the gross contamination of pastures and it is to be expected that the danger to succeeding lamb crops will be considerably reduced. Because R.D.976 has not been found to control the other common nematodes of lambs, medication should also be carried out with a full therapeutic dose of phenothiazine. A drench containing 2½ grammes of R.D.976 together with 10 grammes of phenothiazine will be sufficient to control Nematodirus and other nematodes susceptible to phenothiazine in lambs between 30 and 60 lb. liveweight, lambs under 30 lb. should be given 1 oz. of this drench, and over 60 lb., 3 oz.

Conclusions

The anthelmintic R.D.976 has been demonstrated as being efficient for the removal of Nematodirus in sheep. Medication of lambs during the susceptible period prevents heavy infestations and allows the

development of their natural immunity to take place. Even where the disease described as nematodiriasis is not known to occur the removal of heavy burdens of nematodirus worms is expected to be of direct benefit to the lambs as well as reducing pasture contamination. It remains to be shown if medication can be effective once symptoms have developed, but the control of subclinical heavy infestations has been accomplished. This compound has not yet been tested against Nematodirus in cattle and it should be tried out against other parasites in domesticated animals at home and abroad.

The author would have liked to have been able to report observations on the use of this drug in a larger number of lambs in the field but the seasonal incidence of the parasites gives only a short period of time in which to work. However, the opportunity has been taken to elucidate more fully the tolerance of young lambs to this compound with the aid of a colleague, B. S. Cooper. Autumn-born Dorset horn lambs are being used for this purpose and while 500 mg. per kg. has been well tolerated as reported in Table IV it appears that toxicity may arise in small lambs under 6 weeks old if given over 400 mg. per kg. 250 mg. per kg., however, is well tolerated and this is 2½ times the therapeutic dose.

Further results and toxicity data on the use of this compound and mixtures containing phenothiazine will be published in due course.

Acknowledgments.—The author wishes to thank the Directors of Boots Pure Drug Co. Ltd., for permission to publish this work; Mr. W. M. Brownlie, Head of the Veterinary Science Division, for his help; the Chemistry Division of the Research Department, particularly Dr. T. I. Watkins, for Chemical support; and Mrs. D. Delic, Mrs. A. Hill, and Mrs. M. Birch for laboratory assistance.

References

KATES, K. C., & TURNER, M. S. (1953). *Amer. J. Vet. Res.* XIV. 72.
KINGSBURY, P. A. (1953). *Vet. Rec.* **65.** 167.
LEIPER, J. W. G. (1952). *Ibid.* **64.** 438.
RAWSON, G. W., FERRELL, B. D., REYNOLDS, A. C., & MAYER, R. L. (1955). *Antibiot. and Chemother.* V. 622.
STAMP, J. T., DUNN, A. M., & WATT, J. A. A. (1955). *Scot. Agric.* **34.** 213.
THOMAS, R. J., & STEVENS, A. J. (1956). *Vet. Rec.* **68.** 471.

CHINESE EGGS

The *British Medical Journal* startled its readers recently by attributing the increase in enteritis observed during recent years to the importation of eggs from China. These eggs are imported as frozen whole egg, dried egg, or dried albumin, and used for making cakes and synthetic cream. The organism which causes paratyphoid fever in man was recovered from these eggs. As this particular bacterium is not found in chickens but is an inhabitant of the alimentary tract of man, its presence suggests that the standard of hygiene of the Chinese poultry keeper leaves much to be desired.

Clinical Notes

COENURUS IN AN UNUSUAL SITE

J. T. Baxter
Veterinary Research Division, Stormont, Belfast

A fluctuating swelling was present in the subcutaneous tissues of the leg of a ewe. The swelling, which was situated a few inches above the hock, had been seen to develop over a period of about 7 months. An incision was made into the area and a cyst was expelled.

The cyst was a coenurus, the larval stage of a tapeworm of the genus Multiceps. Although collapsed at the time of examination it appeared that the cyst would have been about the size of a hen's egg when *in situ*. Many larval scolices were present, arranged in irregular clumps on the inner surface of the cyst wall. The arrangement resembled *Multiceps multiceps* (*Coenurus cerebralis*) rather than *M. serialis*.

The site is an interesting one in that *M. multiceps* usually favours the central nervous system of ungulates where it may give rise to gid or other nervous disturbance. If the coenurus comes to rest elsewhere in the body, it is said to fail to develop. The predilection site of the coenurus of *M. serialis* is the inter-muscular connective tissue of rabbits and hares. The specimen is either *M. multiceps* in an unusual site of its usual host or *M. serialis* in a usual site of an unusual host. The distribution of the larval heads within the cyst lends support to the former view. It does not appear likely that the coenurus is the larval stage of *M. smythi*, the species recently described by Johri (1957) from dogs in Dublin, as his specimens, which were adult worms, bore 44 rostellar hooks. The scolices of the coenurus described here bore less than 30 hooks.

Clapham's opinion, quoted by Wardle & McLeod (1952), is that *M. serialis* and *M. multiceps* are different strains of the same species which have adopted different hosts and predilection sites. The writer understands from Mr. J. F. Gracey (in a private communication) that of 752 sheep consigned by veterinary surgeons to 17 provincial abattoirs for emergency slaughter 2.1 per cent. were cases of cerebral coenuriasis. It is remarkable, in view of those facts, that aberrant coenuri are not more frequently observed.

This note is submitted as it may be of interest in the differential diagnosis of fluctuating superficial swellings of slow growth in the sheep.

Acknowledgment. I wish to thank Mr. W. H. McFerran, B.SC., B.AGR., M.R.C.V.S., who provided the specimen and clinical description.

References

JOHRI, L. N. (1957). *Parasitology.* **47.** 16.
WARDLE, R. A., & MCLEOD, J. A. (1952). "The Zoology of Tapeworms." University of Minnesota Press, Minneapolis.

RUPTURE OF THE DIAPHRAGM WITH PROLAPSE OF THE RETICULUM IN A NEWLY CALVED COW

A. J. Adams and D. C. Smith
Thornbury, Bradford

The following case is reported because of its unusual nature.

Subject. Four- to five-year-old Ayrshire cow.

Calved twins unaided on August 14th, 1957. Seen on August 15th when the only symptoms were dullness and loss of appetite. It was thought then that the dose of salts given by the owner might be the cause of this, and a policy of "wait and see" was followed. Seen again on August 17th when there was some tympany with profuse diarrhoea.

A provisional diagnosis of traumatic reticulitis was made for there was now an easily induced grunt. Seen again on August 18th with a view to rumenotomy but there was some improvement in the general condition and surgery was postponed. Relapse on the 19th when rumenotomy was carried out.

Operation. On manual exploration of the rumen and reticulum it was found that the hand could barely be forced into the reticulum. Torsion was suspected. The peritoneal surface of the stomachs was explored and an annular band was found surrounding the reticulum. Manipulation failed to correct this condition and slaughter was advised.

Post-mortem *Examination.* On *post-mortem* examination it was found that the reticulum had prolapsed through a rupture in the diaphragm and unbreakable adhesions had formed. There was no evidence of a foreign body.

It is our opinion that the condition had been present for some time, and certainly before calving on the 15th. One wonders how and when the condition arose in the first place. The cow was perfectly healthy up to calving on the 15th. The reticulum formed a perfect plug in the rupture and it was held securely in place by the adhesions; there was no evidence of respiratory distress when the peritoneum was incised.

THE FUNCTIONAL VARIABILITY OF *UTERUS DIDELPHYS*

G. H. Arthur
Royal Veterinary College, Streatley

Segmental aplasia of the Muellerian ducts, or persistence of their median walls, leads to various developmental defects of the tubular genital tract. These congenital conditions are seen occasionally in cattle and the following case of *Uterus didelphys* was of interest because it was pregnant.

When slaughtered, a 5-year-old Ayrshire cow was 7 months pregnant in the right uterine horn. This cornu contained a female foetus in anterior presentation. The amniotic fluid was, as usual at this stage, mucoid and measured 2 pints, and there were 9 pints of urine-like allantoic fluid.* The left uterine horn was only slightly distended in its free part and, on incising it, approximately a pint (½ litre) of yellowish uterine milk flowed away. On further dissection it was seen that this non-pregnant horn, although normally conjoined with its fellow, did not open into a common uterine body, but communicated only with a separate cervical canal which was occupied by a tenacious mucous seal. The right pregnant horn also had its own cervical canal, running alongside that of the left—also with a pregnancy seal—and both cervices opened separately into the vagina. Each os uteri was occupied by a substantial plug of mucus. The vagina was normal.

As was to be expected, cotyledonary development was normal in the pregnant horn but caruncles were not visible in the non-pregnant horn. The amount of uterine milk in the non-gravid cornu was surprisingly large—presumably because of gestational glandular activity and the absence of an embryo and membranes to effect resorption.

Although the uterine milk was not purulent, it is feasible that in such a case the uterine secretion could become infected endogenously—as sometimes occurs in association with luteinised ovarian cyst—and pyometra result. In these circumstances there is the intriguing possibility of simultaneous pregnancy and pyometra in the same animal.

The history was that previously the cow had borne normally two calves and the distribution of the corpora albicantes indicated that both pregnancies had been in the right horn.

* Approximately 5 litres.

A SUGGESTION TO FARMERS

Professor M. M. Cooper (Dean of the Faculty of Agriculture, Durham University), speaking at Nantwich last week, suggested that farmers were not making anything like the fullest use of advances made in veterinary science.

He was addressing a large audience at the annual Reaseheath Association lecture arranged by the students' body of the Cheshire School of Agriculture.

"Farming has become so complex that a man cannot be expected to carry everything in his own head. There is no shame in consulting experts," he said.

Labour costs should be cut as far as possible by modern techniques, but the principal thing to be tackled in the dairy industry was the cost of feedingstuffs. At present something like 3½ lb. of concentrate were used for every gallon of milk produced. The man who would score was the one who could maintain his yield per cow and cut his concentrate bill in half.

On livestock improvement, Professor Cooper criticised the "worship" of the appearance of individual animals instead of the main attention being paid to their capacity to transmit desirable characteristics.

Urinary Excretion of Amino-acids in Normal Dogs and in Those with Experimentally-induced Cirrhosis and with Altered Blood Supply to the Liver

BY

J. R. DOGGART,* J. A. McCREDIE,† and R. B. WELBOURN‡

Department of Surgery, The Queen's University of Belfast

SUMMARY.—A paper-chromatographic method has been used in the study of the amino-acid excretion in the urine of dogs. The normal pattern, containing taurine, methylhistidine, and glutamine as the strongest spots is described, together with its daily variation. The effects on the amino-acid excretion of porta-caval anastomosis and total arterialisation of the blood supply to the liver of the normal and cirrhotic dog have been described; taurine and glutamine are most sensitive to these procedures. The excretion in oestrus and pregnancy is abnormal.

THE excretion of amino-acids in the urine has been studied extensively in various conditions in man and its investigation by chromatographic methods—in particular paper chromatography—has led to a better understanding of amino-acid metabolism. Abnormal patterns of amino-acids in the urine may be produced either by a "renal" or by an "overflow" mechanism (Dent & Walshe, 1954). In the former hepatic function is normal, but the *renal* threshold is lowered and amino-acids escape in the urine. In the latter renal function is normal, but the *liver* is diseased and forms abnormal quantities of amino-acids, some of which "overflow" and are excreted.

Different pathological states of the liver produce characteristic changes in the amino-acid pattern in the urine (Dent & Walshe, 1954):—

1. *Acute hepatic disease with necrosis* (e.g. *acute yellow atrophy and infective hepatitis*)

The blood amino-acid level rises sharply because of the failure of deamination in the liver and the accumulation of the products of hepatic cellular necrosis. The number of amino-acids in the urine and the amount of each are increased. The more severe the necrosis, the greater is the amino-aciduria.

2. *Chronic hepatic disease* (e.g. *portal cirrhosis with hepato-cellular damage*)

The total urinary amino-nitrogen shows little change, but there is increased excretion of cystine, β-amino-*iso*-butyric acid, methylhistidine, taurine, methionine, and ethanolamine. The ethanolamine is of special importance because of its key position in the synthesis of choline, deficiency of which leads to fatty infiltration of the liver. Walshe (1953) found that, because of variations in the activity of the disease, it was necessary to examine the urine repeatedly.

Amino-acids in the urine of the normal *dog* have been studied very little by paper chromatography, and the patterns which have been found have not been consistent. Dent and Schilling (1949) found large amounts of glutamic acid and methylhistidine and smaller amounts of many other amino-acids, but they found no taurine. Datta and Harris (1951, 1953), on the other hand, found only a small amount of glutamic acid (or glutamine) and large amounts of methylhistidine and taurine. They also examined the urines of a number of other species and found that the amino-acid pattern varied considerably but was constant for any one species. Methylhistidine was present only in the urine of carnivora and the suggestion was made that it was derived from anserine which is a normal constituent of vertebrate muscle. We have found no reports of the effects on amino-acid excretion of experimental alterations of the blood supply to the liver or the administration of carbon tetrachloride.

The main purpose of this investigation was to compare the effects of porta-caval anastomosis alone and of porta-caval anastomosis combined with total arterialisation of the portal vein in dogs with previously healthy livers and in those with hepatic cirrhosis induced by carbon tetrachloride. Most of the investigation has been published elsewhere (McCredie, Doggart & Welbourn, 1957). We report here the urinary amino-acid findings. We also report the findings in a dog in oestrus and in another during pregnancy.

Material and Methods

Six groups of mongrel dogs of both sexes were used: (1) controls (12 dogs); (2) porta-caval anastomosis (4 dogs); (3) total arterialisation of the portal vein (3 dogs); (4) cirrhosis (10 dogs); (5) cirrhosis and porta-caval anastomosis (3 dogs); and (6) cirrhosis and total arterialisation of the portal vein (3 dogs). Their weights at the beginning of the experiment ranged from 5 to 14 kg. The diet consisted of "pig-starter meal" (65 per cent.) mixed with raw horse meat (35 per cent.). The average intake of protein was 7 grammes per kg. body weight per day. Cirrhosis was induced by the administration of carbon tetrachloride by stomach tube in a dosage of 2 ml. per kg. of body weight once or twice weekly. Cirrhosis developed in from 21 to 64 weeks. Porta-caval anastomosis was performed by dividing the portal vein, ligating its hepatic end, and anastomosing

* Roche Research Fellow in Biochemistry.
† Principal Tutor in Surgery; in receipt of the Linen Industry Research Grant.
‡ Reader in Surgery.

the distal end to the side of the posterior vena cava. Arterialisation of the portal vein was accomplished by placing a jugular-venous autograft between the side of the aorta below the renal arteries and the proximal end of the portal vein, after establishing a porta-caval shunt (McCredie, Doggart & Welbourn, 1957a). No further carbon tetrachloride was given after operation to the cirrhotic dogs.

The urinary amino-acids were investigated in the following way. Samples of urine were collected by placing the dogs in metabolism cages until they had micturated. After operation the specimens were taken weekly for the first 4 weeks and then once every month; the urines from the dogs receiving carbon tetrachloride were examined monthly. The specimens were stored at −30° C. The nitrogen content of the urine was determined by a micro-Kjeldahl technique and samples containing 500 μg. of nitrogen were examined chromatographically by the method of Datta, Dent, and Harris (1950). The urine was desalted electrolytically in order to obtain definition of the spots. Each sample was applied to the corner of a sheet (20 cm. × 20 cm.) of Whatman No. 1 filter paper with a known amount of solution of a standard amino-acid, and two-dimensional separation was achieved in water-saturated phenol and collidine-lutidine solvents. The papers were dried in a current of air, sprayed with ninhydrin (in *n*-butanol), and allowed to stand for 24 hours at room temperature, during which time the amino-acid spots developed. Each amino-acid was identified by reference to a "map of spots," and a semi-quantitative estimation was made by comparing the size of the spot and its intensity of colour with those of the standard. The standard was given an arbitrary strength of 5 "ninhydrin units" and the strengths of the amino-acids were graded by reference to this.

Results

Group 1.—Controls (Table I and Fig. 1)

The amino-acid pattern was fairly constant, but some variation was found both among the different dogs and in the same dogs on different days (Table II). Taurine, methylhistidine, and glutamine usually gave the strongest spots. Taurine was always present, but its concentration varied greatly.

Group 2.—Porta-caval anastomosis (Table I and Fig. 2)

In the last specimens of urine taken before the animals died or were killed the number of ninhydrin units was halved, compared with the control group. The change was greatest in taurine. Excretion of glutamine increased to a value of 6 ninhydrin units in one dog when signs of meat intoxication were present.

Group 3.—Total arterialisation of the portal vein (Table I)

The excretion of glutamine was low in the first few weeks, but tended to increase later. In the last specimens which were collected before death the total numbers of amino-acids and of ninhydrin units were about the same as in the controls.

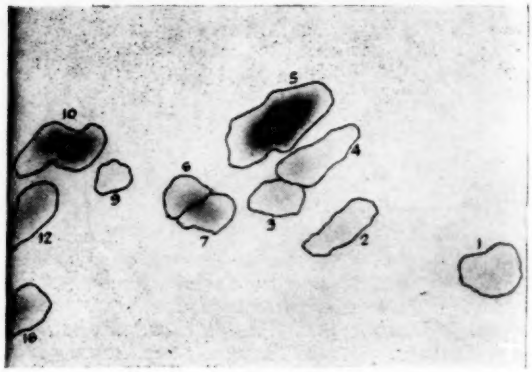

FIG. 1.—Chromatogram of urine from control dog (see key after Fig. 3).

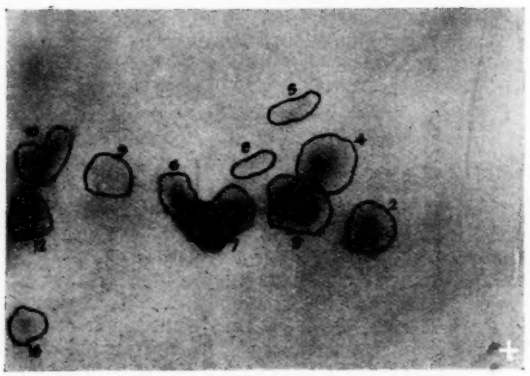

FIG. 2.—Chromatogram of urine from dog with meat intoxication following porta-caval anastomosis (see key after Fig. 3).

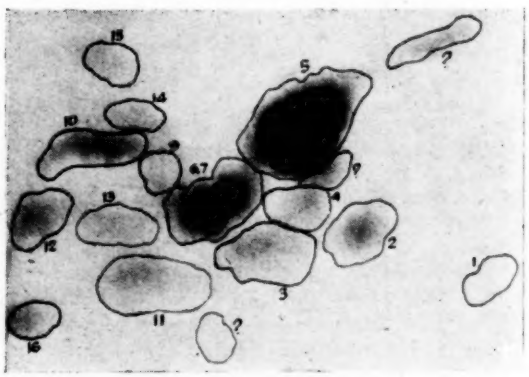

FIG. 3.—Urinary chromatogram from dog with cirrhosis.

KEY.—1: cysteic acid; 2: glutamic acid; 3: glycine; 4: serine; 5: taurine; 6: alanine; 7: glutamine; 8: threonine; 9: β-amino-*iso*-butyric acid; 10: methylhistidine; 11: lysine; 12: arginine; 13: γ-amino-*n*-butyric acid; 14: valine; 15: leucine; 16: peptide.

Group 4.—Cirrhosis (Table I and Fig. 3)

In the last specimens taken after cirrhosis had been established the total numbers of amino-acids and of ninhydrin units were about the same as those in the control group. The dogs in which cirrhosis was most severe histologically excreted large quantities of taurine. In two animals, one of which died from liver failure, the excretion of glutamine was greater (6 and 7 ninhydrin units respectively) than in any of the controls.

Group 5 and 6.—Cirrhosis and operation (Table I)

Neither porta-caval anastomosis nor total arterialisation caused any significant changes in the amino-acid excretion.

Discussion

The urinary amino-acid pattern of the normal dog was found to be different from that reported in man. Taurine generally gave the strongest spot, whereas glycine is the predominant spot in chromatograms of human urine. Excretion of glutamine was greater in the dog than in man. The large excretion of methylhistidine was probably caused by the high content of horse meat (35 per cent.) in our dogs' diet.

The raised excretion of glutamine by the dog with symptoms of meat intoxication after porta-caval anastomosis occurred simultaneously with the presence of a high level of blood-ammonia (4.7 μg. ammonia -N per ml.) (McCredie, Doggart & Welbourn, 1957). The excretion of glutamine was also elevated in the dogs with total arterialisation, although symptoms of meat intoxication did not occur. It is unlikely, therefore, that glutamine itself is responsible for the signs of meat intoxication. Flock, Block, Grindlay, Mann, and Bollman (1953) found that the amount of glutamine in the brain and muscle of the dog increased greatly following hepatectomy.

The amino-acid excretion in the urine of dogs with cirrhosis increased only when there was severe liver damage. When liver damage was less severe there was a selective amino-aciduria affecting taurine and glutamine. The excretion of taurine is increased in human patients with cirrhosis but that of glutamine is not.

Following porta-caval anastomosis in dogs with cirrhotic livers the excretion of taurine rose at first and fell later; the decrease may have been caused by the withholding of carbon tetrachloride.

The inadequacy of single estimations of the amino-acids in the urine, because of daily variations, needs

TABLE I

EXCRETION OF AMINO-ACIDS IN THE URINE OF DOGS (ninhydrin units)

Amino-acid	1 Normal (12 dogs)	2 Porta-caval anastomosis (4 dogs)	3 Total Arterialisation of portal vein (3 dogs)		4 Cirrhosis (10 dogs)	5 Cirrhosis + Porta-caval anastomosis (3 dogs)		6 Cirrhosis + arterialisation (3 dogs)
			a	b		a	b	
Alanine	1.4	0.7	1.2	1.7	2.2	1.7	2.0	0.3
β-Amino-*iso*-butyric acid	0.7	0.4	0.5	1.5	0.9	1.2	1.7	1.2
γ-Amino-*n*-butyric acid	–	–	–	1.0	–	–	1.7	–
Arginine	1.1	0.6	0.2	1.5	0.7	0.8	1.2	1.3
Aspartic acid	–	–	–	–	–	–	–	–
Cysteic acid	0.5	0.2	0.2	0.2	0.4	0.3	0.3	0.3
Glutamic acid	0.6	0.1	0.3	1.7	1.0	1.3	1.3	0.5
Glutamine	2.1	2.3	0.2 (*g*)	3.3 (*h*)	2.9	3.0	2.3	1.7
Glycine	1.8	1.6	0.8	2.7	1.5	2.0	0.8	1.7
Histidine	–	–	–	–	–	–	0.7	–
Hydroxyproline	–	0.1	–	0.7	–	–	–	–
Leucine	–	–	–	1.3	0.1	–	–	–
Lysine	0.1	–	0.2	0.2	0.1	–	0.2	–
Methylhistidine	2.5	2.3	1.8	3.7	2.1	2.3	2.3	3.7
Phosphoethanolamine	0.1	–	0.3	–	–	–	–	–
Proline	–	–	–	–	–	–	–	–
Serine	1.7	1.2	0.2	2.3	1.6	0.3	1.0	1.5
Taurine	8.2 (*a*)	0.6 (*d*)	4.0	2.3	10.8	10.3	4.8	12.0
Threonine	0.4	0.2	–	0.8	0.3	–	–	–
Valine	–	0.1	–	1.0	–	0.5	0.5	–
Peptides	0.7	0.4	0.3	0.5	0.6	0.7	0.2	0.5
Mean number of amino-acids	10.3 (*b*)	8.0 (*e*)	8.0	13.0	10.4	10.7	11.0	9.7
Mean number of ninhydrin units	22.4 (*c*)	11.3 (*f*)	10.5	26.0	25.4	24.5	21.0	24.8

All figures refer to mean values for the group. The standard deviations of those which were used for statistical analysis are shown below. The values in groups 2, 3*b*, 5*b* and 6 are those for the last specimens examined before death. The values in groups 3*a* and 5*a* were obtained 1 to 4 days after operation. Those in Group 4 were obtained when cirrhosis was established. (*a*) S.D. 5.7 ; (*b*) S.D. 1.9 ; (*c*) S.D. 8.6 ; (*d*) S.D. 0.5 ; (*e*) S.D. 2.4 ; (*f*) S.D. 8.0.

Statistical Analysis : (*a*) v. (*d*) : $t = 2.38$, D.F. = 14, $0.05 > P > 0.01$
(*b*) v. (*e*) : $t = 1.95$, D.F. = 14, $P > 0.05$
(*c*) v. (*f*) : $t = 4.34$, D.F. = 14, $P < 0.001$
(*g*) v. (*h*) : $t = 3.83$, D.F. = 2, $0.1 > P > 0.05$.

emphasising. Alterations in the output of amino-acids in the dogs studied did not show a close correlation either with the clinical signs of hepatic failure or with the efficiency of bromsulphthalein excretion (McCredie, Doggart & Welbourn, 1957).

TABLE II

EXCRETION OF AMINO-ACIDS IN THE URINE OF ONE DOG ON FOUR SEPARATE OCCASIONS (ninhydrin units)

	Day 1	Day 2	Day 3	Day 4
Alanine	2	1	1	1
β-Amino-*iso*-butyric acid	0.5	1	1	–
Arginine	1	2	1	1
Cysteic acid	0.5	0.5	–	–
Glutamine	2	3	1	1
Glycine	2	3	1	0.5
Methylhistidine	3	5	3	4
Serine	2	2	1	0.5
Taurine	2	10	2	3
Threonine	–	4	–	–
Peptides	0.5	1	0.5	–
Number of amino-acids	10	11	9	7
Total number of ninhydrin units	15.5	32.5	11.5	11.0

Note on the urinary excretion of amino-acids in oestrus and pregnancy

A high concentration of amino-acids was found in a specimen of urine obtained from one animal during oestrus (Table III). Several spots on the chromatogram were not identified, including one in the position corresponding to hydroxylysine. When the chromatogram was run in the presence of acetic acid (50 per cent. v/v) this spot behaved as if it were lysine; another large spot, brownish-yellow on developing for 24 hours at room temperature, but turning green on heating for 10 minutes at 100° C., appeared in the position of glutamic acid. The taurine excretion was very low.

TABLE III

AMINO-ACID EXCRETION IN URINE DURING OESTRUS AND PREGNANCY (ninhydrin units)

		Pregnancy		
	Oestrus	4th week	5th week	Six days after termination
Alanine	4	2	1	1
Arginine	1	0.5	0.5	0.5
β-Amino-*iso*-butyric acid	10	1	0.5	0.5
Cysteic acid	0.5	0.5	0.5	0.5
Glutamine	6	2	3	2
Glutamic acid	3	–	–	1
Glycine	5	2	1	1
Lysine	–	–	–	0.5
Methylhistidine	4	2	3	0.5
Phosphoethanolamine ...	–	0.5	1	–
Proline	–	1	2	1
Serine	4	0.5	0.5	0.5
Taurine	0.5	9	23	7
Threonine	0.5	–	–	–
Peptides	1	0.5	–	1
Unidentified	12.5 (4 spots)	–	–	–
No. of amino-acids ...	16	12	11	13
No. of ninhydrin units...	51.5	21.5	36	17

Two specimens were examined from another animal which was later found to be pregnant (Table III). The second specimen, taken during what was thought to be the fifth week of pregnancy, had a very high amino-acid content; the taurine excretion was as high as that found in any cirrhotic animal. One week after hysterectomy the taurine excretion had returned to a normal value.

References

DATTA, S. P., DENT, C. E., & HARRIS, H. (1950). *Science.* **112.** 621-3.
———, & HARRIS, H. (1951). *J. Physiol.* **114.** 39-41.
———, & ——— (1953). *Ann. Eugenics.* **18.** 107-16.
DENT, C. E., & SCHILLING, J. A. (1949). *Biochem. J.* **44.** 318-35.
———, & WALSHE, J. M. (1954). *Brit. Med. Bull.* **10.** 247-50.
FLOCK, E. V., BLOCK, M. A., GRINDLAY, J. H., MANN, F. C., & BOLLMAN, J. L. (1953). *J. Biol. Chem.* **200.** 529-36.
MCCREDIE, J. A., DOGGART, J. R., & WELBOURN, R. B. (1957). *Brit. J. Surg.* **45.** 83-100.
WALSHE, J. M. (1953). *Quart. J. Med.* **22.** 483-505.

STUDY TOUR IN DENMARK FOR BRITISH VETERINARY SURGEONS

The Danish Institute has extended an invitation to British veterinary surgeons to take part in a study tour in Denmark for the purpose of seeing veterinary services in that country. The suggested dates are as follows: Leave Harwich for Esbjerg on August 30th, and return to Harwich on September 12th.

The Danish Institute, sponsored by its Government, would pay certain expenses in Denmark, but the tourists would pay for travelling and hotels at a cost to each participant of approximately £40 (second-class travel).

The programme for the tour will be arranged by the Danish Institute in co-operation with the Danish Veterinary Association. The precise itinerary has not yet been decided, as our Danish colleagues think that members of the profession in this country might like to make suggestions about the kind of things they would most wish to see. Apart from particular requirements, it is intended that the study tour will cover "a little of everything."

It is not necessary to enlarge upon the high quality of Danish veterinary skill and knowledge, and there is no doubt that those who decide to visit Denmark will have a very enjoyable and instructive time.

Will members of the profession who would like to take part in the study tour please write *direct to the Danish Institute, 3, Doune Terrace, Edinburgh. 3, and not to the B.V.A.*, making such suggestions about matters of particular interest as they may wish?

Current Literature

ABSTRACTS

Influence of Particle Size on Anthelmintic Efficiency of Phenothiazine. GORDON, H. McL. (1956). *Aust. Vet. J.*

The Relationship of Particle Size and the Efficiency of Phenothiazine. DOUGLAS, J. R., *et al.* (1956). *Amer. J. Vet. Res.*

The Efficiency of Phenothiazine against *T. colubriformis* in Sheep. WHITTEN, L. K. (1956). *N.Z. vet. J.*

The Use of Fine Particle Size Phenothiazine against *T. colubriformis* in Sheep. THOMAS, P. L., & ELLIOTT, D. C. (1957). *N.Z. vet. J.*

These are four important papers reporting large-scale experiments on the effect of the particle size of phenothiazine preparations on their anthelmintic efficiency. They demonstrate that very finely ground material is much more effective than the usual commercial grades against the trichostrongyle parasites of sheep, most notably the intestinal *Trichostrongylus* spp. or black scour worms and to some extent the brown stomach worms, *Ostertagia* spp.

The implications of this work are of fundamental importance in that they appreciably reduce the value of many of the thousand or so papers about phenothiazine of unknown particle size already published, and make it imperative that all future contributions on the subject should quote the particle-size structure of the phenothiazine preparations used. It is unfortunate, however, that the authors of the papers under discussion have started, albeit unwittingly, a fresh train of possible confusion by failing to define precisely what they mean by such terms as mean, average, or nominal particle size and the essential information as to which methods of estimating these values were employed. There is even a failure to state whether the values quoted are for percentage of particles by number or by weight, which are completely different quantities. A further feature which would perhaps have helped future workers would have been inclusion of information as to whether the preparations used were made by wet or by dry grinding, since factors affecting the surface of the particles must be of great importance in finely ground material.

Enough has been said perhaps to warn the non-specialist reader that the results of experiments of this kind need very careful assessment before generalised conclusions can be drawn. However, interpreted broadly, the papers agree in demonstrating that phenothiazine of particle size over 10 μ diameter will remove less than half of the intestinal *Trichostrongylus* spp. present in sheep at a dose rate of around 600 mg. per kg. Under 10 μ preparations are much more efficient, removing about 75 per cent. of these worms at the same dose rate, and if all material is under about 4 μ efficiencies of up to 98 per cent. can be obtained.

A similar effect is recorded against *Ostertagia* spp. although the response in this case was less consistent and some of the work indicated that the particle size might have to be appreciably below 4 μ to ensure first-class results. An inverse relationship between particle size and efficiency was also demonstrated in respect of *Oesophagostomum* spp. and *Chabertia ovina* with a limiting value of 4 μ, below which size it seems likely that the drug is too rapidly absorbed and insufficient reaches the large intestine where these worms live. There was no clear evidence that fine material is likely to be of much value for control of *Nematodirus* spp. or of immature specimens of any trichostrongylids.

These reports will undoubtedly stimulate commercial production of finer phenothiazine and useful improvements in efficiency against the majority of the trichostrongyles of ruminants can be expected. British practitioners who wish to acquire further information should first of all consult the paper by Thomas and Elliott which sets out the data briefly and clearly; they would also find the paper by Whitten, which mentions other anthelmintics as well, of considerable interest.

Studies on Anthelmintics for Sheep. GORDON, H. McL. (1957). *Aust. vet. J.*

Gordon gives results of tests showing that 1:8 dihydroxyanthraquinone is a remarkably effective anthelmintic against adult stages of the common helminths found in the large intestine of sheep. A dose of 2 to 3 g. injected into the rumen of sheep 45 to 60 lb. weight removed almost 100 per cent. of *Chabertia ovina* and *Oesophagostomum columbianum* and a very large proportion of the *Trichuris* spp. present. A substantial effect was obtained with doses as small as 1 g., especially against *Chabertia*. The anthelmintic properties of the drug appeared to be independent of its purgative action. Evidence of toxicity was not observed in live animals given therapeutic doses but pathological changes were found in livers and kidneys of sheep killed 1 to 2 weeks after treatment.

The author states that doses of 3 g. were generally effective against *Hæmonchus contortus* but not against *Trichostrongylus* spp. He concludes that the drug has no practical advantage over phenothiazine as a sheep anthelmintic except in cases where necessity for treatment is restricted to removing worms of the large bowel when the low cost of the small dose required operates in its favour.

Studies in Anthelmintics for Sheep: Piperazine Compounds. GORDON, H. McL. (1957). *Aust. vet. J.*

The author tested piperazine hexahydrate, piperazine salts, and the piperazine-CS_2 complex against nematodes in sheep. The last of these had some effect against *Haemonchus contortus* when administered into the abomasum, otherwise the compounds were ineffective against this parasite and also against *Trichostrongylus colubriformis*. At a dose rate of

(*Concluded at foot of col. 1 overleaf*)

News and Comment

R.C.V.S. HOUSE OF COMMONS RECEPTION

The President, Mr. G. N. Gould, held a small Reception at the House of Commons on the evening of Tuesday, March 25th, prior to his departure on a tour of the British Caribbean Federation, on behalf of the British Council, and also to meet the members of the joint delegation of the College and the University of London on veterinary education in East Africa, prior to departure. The President of the B.V.A., Mr. J M. Ingram, accepted an invitation, and among others who accepted were:—

From the Colonial Office, the Secretary of State, the Rt. Hon. A. Lennox-Boyd, M.P.; the Permanent Secretary, Sir John Macpherson; the Deputy Secretary, Sir Hilton Poynton; and the Veterinary Adviser, Mr. R. S. Marshall. From the Inter-University Council, Mr. S. J. Worsley. From the British Council, the Director-General, Sir Paul Sinker. The Chairman of the Joint East and Central Africa Board, Lord de la Warr, accepted, as did the following Members of Parliament: Mr. P. H. Collick, Sir James Duncan, Bt., Mr. J. Johnson, and the Rt. Hon. Hilary Marquand. The Ministry of Agriculture was represented by the Deputy Secretary, Sir Richard Manktelow, and the Assistant Secretary, Mr. C. P. Quick. The Vice-Chancellor, Dr. J. F. Lockwood, accepted for the University of London. Representatives of the Joint Delegation were (University) Dr. R. E. Glover, Professor R. Lovell, and Dr. W. R. Wooldridge; (College) Mr. H. Sumner, Mr. J. N. Ritchie, and Mr. S. L. Hignett. Members of the Council of the R.C.V.S. included Professor T. J. Bosworth, Professor L. P. Pugh, Commander J. F. W. Maitland, M.P., Mr. T. F. Peart, M.P., Sir Laurence Watkinson, Mr. L. G. Anderson, and Dr. R. F. Montgomerie. The Registrar, Mr. W. G. R. Oates, was present also.

PRESENTATION TO MR. C. G. ALLEN

The Lord Mayor of Birmingham, Alderman J. J. Grogan, presented on March 17th a gold watch and a tribute inscribed on vellum to Mr. C. G. Allen, the city's chief veterinary officer. The gifts were made on behalf of the Birmingham and District Butchers' and Pork Butchers' Association.

The presentation took place at the Association's annual dinner and dance and was in recognition of 30 years' lecturing to students at the Birmingham Butchers' College.

The tribute was signed by Mr. W. T. Baker, founder of technical education for Birmingham butchers; Mr. W. S. A. Jones, this year's president of the Association; and Mr. H. Baker, chairman of the butchers' Technical Education Sub-committee. Telegrams of congratulation were also sent from the staff and students of the Butchers' College.

UNIVERSITY NEWS

Edinburgh

Faculty of Medicine

The undermentioned candidates have passed the Third Professional Examination (Part II) in the subjects of Veterinary Pathology, Bacteriology, and Parasitology for the degree of Bachelor of Veterinary Medicine and Surgery:—

Care, Anthony D.; Davies, David W.; Davis, Marjorie A.; Gunn, Sydney D.; Harris, Grenville W.; Henry, Robert R.; Jones, Alan P.; Ker, John; Lake, David E.; Lawson, Gordon H. K.; Lovett, Charles I.; McGregor, Donald S.; MacLeod, Brenda R.; Marshall, Leslie; Mathieson, Andrew O.; Munro, David; Neill, Robert H.; Nicholson, Graeme G.; Seymour, Stanley; Strathern, Moira St. C. W.; Swift, Thomas; Turnbull, Robert W.; Ure, William S.; Watson, Ewen E. B.

The undermentioned candidates have passed in the subject of Veterinary Pathology of the Third Professional Examination (Part II) for the degree of Bachelor of Veterinary Medicine and Surgery:—

Anderson, William G. F.; Booth, James M.; Gordon, Mary C. M.; James, William T.

The undermentioned candidates have passed in the subject of Veterinary Bacteriology of the Third Professional Examination (Part II) for the degree of Bachelor of Veterinary Medicine and Surgery:—

Allsup, Thomas N.; Atkinson, William I.; James, William T.; Logan, Ernest F.; Simpson, David T.; Wahler, Saw; Watt, John G.

The undermentioned candidates have passed in the subject of Veterinary Parasitology of the Third Professional Examination (Part II) for the degree of Bachelor of Veterinary Medicine and Surgery:—

Allsup, Thomas N.; Atkinson, William I.; Booth, James M.; Gordon, Mary C. M.; Logan, Ernest F.; Simpson, David T.; Wahler, Saw; Watt, John G.

The undermentioned candidates have passed in the subject of Physics of the First Professional Examina-

---

Abstracts.—*Concluded.*

4 g. the effect of the compounds against *Chabertia ovina* was poor but 100 per cent. removal of *Oesophagostomum columbianum* was obtained in every case. The difference in efficiency against the two latter genera is comparable with that shown by piperazine compounds against *Strongylus* spp. and "small strongyles" in the horse (and *Ancylostoma* and *Uncinaria* in the dog) being tentatively related to feeding habits of the parasites.

Two interesting results of the work were a demonstration of the toxicity of piperazine and copper-nicotine given together and an observation on the very rapid action of piperazine against *Oesophagostomum*, suggesting possible absorption of the drug followed by re-excretion into the large bowel. No data are given for *Nematodirus* spp. which are the the only parasites of sheep for which piperazine is used in Britain.

P. A. K.

tion for the degree of Bachelor of Veterinary Medicine and Surgery:—

Aird, James G. S.; Barabas, Arpad Z.; Binnie, William D.; Bishop, Keith F. S.; Brown, Byron J.; Cathcart, Hugh A. A.; Clark, William A.; Copland, Alexander N.; Doe, Ian; Ede, Megeri; Ferguson, Kenneth R. C.; Forbes, Anne; Forrest, Dugal T. M.; Frankland, Anthony L.; Freer, Roger J.; Gardner, Ronald E.; Gordon, Angus S. M.; Grant, Donald G. A.; Grave, Jill B.; Gribbin, Henry J.; Head, Barbara G.; Hill, Michael R.; Hodgson, Jackson; Jackson, Peter S.; Jones, Alfred G.; Kelly, James, M.; Linklater, Karl A.; Linscott, Thomas B.; Loughery, Samuel; McLeod, Alexander P.; Mews, Alastair R.; Morgan, John R. G.; Ridgeway, Andrew E.; Spencer, David G.; Strachan, Euan R.; Taylor, David R.; Taylor, William P.; Thompson, Robert S.; Waters, Richard J.; Watkins, John H.; Whaley, Francis H.; and Wrathall, Anthony E.

The undermentioned candidates have passed in the subject of Veterinary Botany of the First Professional Examination for the degree of Bachelor of Veterinary Medicine and Surgery:—

Aird, James G. S.; Barabas, Arpad Z.; Binnie, William D.; Bishop, Keith F. S.; Brown, Byron J.; Cathcart, Hugh A. A.; **Clark, William A.; Copland, Alexander N.;** Doe, Ian; Ede, Megeri; Ferguson, Kenneth R. C.; Forbes, Anne; Forrest, Dugal T. M.; Frankland, Anthony L.; Freer, Roger J.; Gardner, Ronald E.; Gordon, Angus S. M.; Grant, Donald G. A.; Grave, Jill B.; Gribbin, Henry J.; Hall, Paul G.; Head, Barbara G.; Hill, Michael R.; Hodgson, Jackson; Holland, Roy E.; Jackson, Peter S.; Jones, Alfred G.; Kelly, James M.; Linklater, Karl A.; Linscott, Thomas B.; Loughery, Samuel; McLeod, Alexander P.; Mews, Alastair R.; Moody, Eric E. M.; Ridgeway, Andrew E.; Rowntree, Philip G. M.; Scott, Margaret A. B.; Strachan, Euan R.; Taylor, David R.; Taylor, William P.; Thompson, Robert S.; Waters, Richard J.; Watkins, John H.; Whaley, Francis H.; and Wrathall, Anthony E.

The undermentioned candidates have passed in the subject of Veterinary Anatomy and Histology of the Second Professional Examination for the degree of Bachelor of Veterinary Medicine and Surgery:—

Abbott, John E. D.; Birch, Allen Vaughan-; Calvert, David J.; Campbell, Edward G.; Dawson, Peter S.; Doxey, David L.; Duncan, Walter D.; Eyre, Peter; Fairlie, George; Footman, Brian; Fraser, Thomas W.; Gardner, David W.; Gardner, Edward A.; Gill, Kenneth A. K.; Goad, Lewis; Goodman, Alan P.; Harcourt, Ralph A.; Irwin, Verney C. R.; *Jackson, Peter G. G.; Jobling, Terence; Jones, Meredydd; Lambert, Donald R.; Lowe, William A.; McIlveen, Samuel W. D.; Macmillan, Elizabeth G. M.; Mair, Malcolm L.; †Middleton, Nigel T.; Moar, John A. E.; Moore, Alexander; Pratt, John H.; Radley, David E.; Reeves, Ronald J. C.; Robson, Richard P.; Rollo, David G.; Schermbrucker, Christopher G.; Searles, Patricia A.; Smith, Margaret E.; Somerville, James C.; Somerville, John R.; **Spence, Albert B.; Taylor, Stuart M.;** Thomas, Gruffydd W.; Tindall, John R.; Walton, John R.; Wheeler, Michael R.; Wilkinson, Ian S.; Williamson, Alexander M.; and Wood, Hamish.

* Passed Second Professional Examination with Distinction.

† Passed Veterinary Anatomy and Histology with Distinction.

The undermentioned candidates have passed in the subject of Veterinary Physiology (including Biochemistry) of the Second Professional Examination for the degree of Bachelor of Veterinary Medicine and Surgery:—

Birch, Allen Vaughan-; Bulley, Frank R. T.; Calvert, David J.; Dawson, Peter S.; Doxey, David L.; Eyre, Peter; Fairlie, George; Footman, Brian; Fraser, Thomas W.; Gardner, Edward A.; Gill, Kenneth A. K.; Goad, Lewis; Harcourt, Ralph A.; Irwin, Verney C. R.; *Jackson, Peter G. G.; Lowe, William A.; McIlveen, Samuel W. D.; Macmillan, Elizabeth G. M.; Mair, Malcolm L.; Middleton, Nigel T.; Moar, John A. E.; Moore, Alexander; Oduro, Gottfried A.; Pratt, John H.; Radley, David E.; Reeves, Ronald J. C.; Robson, Richard P.; Rollo, David G.; Schermbrucker, Christopher G.; Seckington, Ian M.; Smith, Margaret E.; Somerville, John R.; Spence, Albert B.; Thomas, Gruffydd W.; Tindall, John R.; Wilkinson, Ian S.; Williams, David A.; and Wood, Hamish.

* Passed Second Professional Examination with Distinction.

The undermentioned candidates have passed in the Part I Examination for the Diploma in Tropical Veterinary Medicine:—

Crosbie, Andrew, M.R.C.V.S.; Fadol, Gaafar Karrar, B.V.SC. (Cairo); Hampshire, Frederick John William, M.R.C.V.S.; Kirby, Ian Ayrton Earle, D.V.M. & S. (Toronto); Mares, Robert Gascoyne, M.R.C.V.S.; Slater, Duthie, M.R.C.V.S.

The undermentioned candidates have passed in the subject of Veterinary Preventive and State Medicine of the Final Professional Examination (Part II) for the degree of Bachelor of Veterinary Medicine and Surgery:—

Archbold, William A. C.; Bewsher, Colin B.; Brown, Charles G. D.; Clark, William T.; Craigie, Elisabeth C.; Cruickshank, Andrew K.; Grigor, John A.; Heywood, Ralph; Jackson, Jane M. T.; Kennedy, Andrew S.; Kinch, David A.; Leek, Barry F.; MacKenzie, Peter K. I.; Mitchell, Benjamin; Montgomery, John F.; Moody, Peter W.; Needham, Ernest J.; Nutt, Peter; Rennie, Lessel J. C.; Rogers, Elizabeth M.; Taylor, Betsy R.; Thomson, James W.; Tribe, George W.; White, Roy O.; and Wright, Iain G. A.

The undermentioned candidates have passed in the subject of Veterinary Obstetrics of the Final Professional Examination (Part II) for the degree of Bachelor of Veterinary Medicine and Surgery:—

Archbold, William A. C.; Brown, Charles G. D.; Clark, William T.; Craigie, Elisabeth C.; Fraser, Daniel M.; Grigor, John A.; Hudson, Geoffrey B.; Jackson, Jane M. T.; Kennedy, Andrew S.; Kinch, David A.; Leek, Barry F.; MacKenzie, Peter K. I.; Mitchell, Benjamin; Nutt, Peter; Rennie, Lessel, J. C.; Rogers, Elizabeth M.; Taylor, Betsy R.; and Wright, Iain G. A.

Liverpool

Degree of B.V.Sc. 3rd Examination, March, 1958

PART II. VETERINARY PATHOLOGY (INCLUDING MICROBIOLOGY AND PARASITOLOGY)

Aspinall, Kathleen M.; Bird, Christine M.; Butterfield, W. E.; Callender, D. E.; Davidson, P. A. S.; Davies, H. S.; Fitton, J.; Hamilton, J. G.; James, W.; Jenkins, J. T.; McMurtry, M. J.; Michael, H. P.; Moody, Enid; Neil, D. H.; Schofield, J. B.; Wild, G. S. P.; and Worthington, P. T.

PART III. ANIMAL HUSBANDRY (INCLUDING GENETICS)

Aspinall, Kathleen M.; Bird, Christine M.; Butterfield, W. E.; Callender, D. E.; Davidson, P. A. S.; Davies, H. S.; Fitton, J.; Hamilton, J. G.; James, W.; Jenkins, J. T.; McMurtry, M. J.; Michael, H. P.; Moody, Enid; Neil, D. H.; Schofield, J. B.; Wild, G. S. P.; and Worthington, P. T.

HOLIDAY EXCHANGES

We have now received some further requests for hospitality from the Continent, and among them are the following suggestions:—

France

Jean-Jacques Bonin, aged 15, hopes to visit this country on an exchange basis for 15 days in either August or September, and to entertain his host for a similar period in the Loire district of France.

Alain Dubreuil, aged 13, wishes to arrange a holiday in England on an exchange basis for 1½ to 2 months this year. If possible, he would prefer to stay either in the country or in a coastal town. He has three younger brothers and a sister, and he lives in a country district in the department of Ain.

Martine de Bardonneche, aged 16, would like to come to England for one month during June or July of this year and to entertain an English girl during the summer of 1959. She comes from the Hautes-Alpes region of France and she speaks English.

Germany

Dr. E. Fuchs, a veterinary surgeon living near Munich, would like to arrange a holiday on an exchange basis for his daughter, aged 13, during the months of July and August.

Members of the profession interested in contacting any of the above are asked to write to THE VETERINARY RECORD at their earliest convenience.

THE INTERNATIONAL VETERINARY CONGRESS, 1959

The Secretary of the British Committee, Mr. W. G. R. Oates, informs us that he has heard officially that the next International Veterinary Congress will be held in Spain at Madrid in the Spring of 1959. He has heard unofficially that the Congress will probably be held in the week commencing Sunday, March 29th, 1959. As soon as further details are received, they will be communicated to members of the profession.

MR. B. M. KERRUISH

Mr. E. A. Tutton writes:—

It must have come as a great shock to many, as it did to me, to read of the passing of Brian Kerruish. When I last saw him at the Cambridge Congress he seemed so fit and well, still in the prime of life, and with many more years ahead of him.

Mention has already been made of his achievements in the sphere of artificial insemination in which he was one of the pioneers in this country. I would like to pay tribute to him as from an old friend and one who went through College with him.

For five years as a student amongst a comparatively small number in the one year I came to know him very well. He had one of the kindest and most unselfish natures of anyone I ever knew. He always put others first and himself last. He had a great sense of humour and could always debunk the pompous or self-opinionated in the kindest possible way; and not least, he would always revel in telling stories against himself.

He was a member of the Student Christian Movement and was not afraid to practise his Christianity when it came to working camps in the vacations and helping those less fortunate than himself.

He was fond of music and played in the university orchestra. I remember seeing his 'cello in his room years later when he was in practice in Chepstow, propped in a corner alongside some calving ropes and a set of slings.

Brian had a fine physique and was a great rugger player. Many happy carefree games we had playing for the fourth team, and later when his true form was appreciated he played for the University at a time when there was no lack of talent and they were at the top of the U.A.U. He was also a great swimmer; I can see him now doing a perfect swallow dive off the top board at New Brighton while we lesser mortals flopped in from less dizzy heights. That was typical of Brian; everything he did he did well, and that applied to his sport, his work, and his religion.

After a period of assistantships he took over a practice in Chepstow and earned the respect and friendship of the farming community during the difficult days of the war. At the end of the war he took up his main interest, artificial insemination, full time and went from strength to strength. The profession has lost a great veterinary surgeon and those of us who knew him a true and loyal friend. We must give our heart-felt sympathy to his wife Pat and three children and say what a great privilege it was to have known Brian Kerruish.

BECHUANALAND VETERINARY DEPARTMENT

The following personnel changes have been made recently in the Veterinary Department of the Bechuanaland Protectorate Service: Director, Dr. K. Unsworth; Deputy Director, Dr. M. S. Reichert. Newly appointed Veterinary Officers: Mr. J. McDougall, Mr. D. C. Williamson, and Mr. J. R. Ward.

VETERINARY SURGEONS TO BROADCAST

Two members of the profession will take part in a farming broadcast programme on Wednesday, April 9th, at 12.30 p.m., from Birmingham. They are Dr. N. S. Barron and Mr. E. C. Straiton, who will be chairman of the session. The subject is "Early Weaning of Pigs." Mr. W. Price, Principal of the Harper Adams College, is to speak also.

PERSONAL

Mr. M. A. P. Simons has been elected to the Council of the British Horse Society. Mr. Simons is a member of the Society's Riding Clubs Advisory Committee, the Pony Club Competition Committee, a Visiting Commissioner of the Pony Club, and Honorary Organiser of the Royal International and Richmond Royal Horse Show Dressage Tests.

Marriage

KIDD—HUTCHINSON.—At St. Michael's Church, Basingstoke, on March 15th, 1958. Alastair R. M. Kidd, B.V.SC., M.R.C.V.S., only son of Mr. and Mrs. R. Kidd of King's Avenue, Morpeth, Northumberland, to Joyce Hutchinson, B.A., only daughter of Mr. and Mrs. J. Hutchinson of 8, Upton Crescent, Basingstoke.

Births

CORRIGALL.—On March 9th, 1958, at "Windsor Villa," Stonehaven, to Marion, wife of William Corrigall, M.R.C.V.S., a son, Erlend.

WHITAKER.—On February 21st, 1958, to Cecilie, wife of Lloyd Whitaker, M.R.C.V.S., of 34, Albion Street, Cheltenham, a son, Richard Lloyd.

COMING EVENTS

April

2nd (Wed.). 20th Ordinary General Meeting of the A.V.T. & R.W.'s at Derby Hall, North Mossley Hill Road, Liverpool, 18, 10.25 a.m.

General Meeting of the Midland Counties Veterinary Society at the Feathers Hotel, Ledbury, 2.45 p.m.

9th (Wed.). Meeting of the Sussex Veterinary Society at the Old Ship Hotel, Brighton, 2.30 p.m.

Annual General Meeting of the Lakeland Veterinary Association at the Rainbow Hotel, Kendal, 6 p.m.

11th (Fri.). Dinner and Dance of the West of Scotland Division in St. Enoch's Hotel, Glasgow, 7.30 p.m.

Special Meeting of the Welsh Branch at Belle Vue Hotel, Aberystwyth, at 2.15 p.m.

12th (Sat.). 12th Annual Dinner of the B.R.X. Club at the Royal Veterinary College, 6 p.m.

16th (Wed.). Combined Meeting of the Royal Society of Medicine, Section of Comparative Medicine, and the Section of Pathology at the Society's House, 5 p.m.

17th (Thurs.). All-day Meeting of the Central Veterinary Society at the Royal Veterinary College, Camden Town, 11 a.m.

23rd (Wed.). Meeting of the Lincolnshire and District Division at the Campbell Hotel, Peterborough, 2.30 p.m.

25th (Fri.). General Meeting of the Mid-West Veterinary Association at the Berkeley Café, Clifton, Bristol, 2.30 p.m.

May

1st (Thurs.). Annual General Meeting of the Central Veterinary Society.

10th and 11th (Sat. and Sun.). 6th Annual Reunion of the R.V.C. '52 Club at Ye Miller of Mansfield, Goring-on-Thames.

BRITISH VETERINARY ASSOCIATION QUARTERLY MEETINGS IN EDINBURGH

Wednesday, April 9th—Royal (Dick) School of Veterinary Studies

10.15 a.m. Small-Animals Committee.
2.15 p.m. Home Appointments Committee.
3.45 p.m. Farm Livestock Committee.

Thursday, April 10th—Royal (Dick) School of Veterinary Studies

9.30 a.m. Finance Sub-committee.
10.00 a.m. Veterinary State Medicine Committee. Committee.
11.30 a.m. Parliamentary and Public Relations Committee.
2.30 p.m. General Purposes and Finance Committee.

Friday, April 11th—Royal (Dick) School of Veterinary Studies

10.15 a.m Council Meeting.

ADDRESSES OF DISEASE INFECTED PREMISES

The list given below indicates, first the county in which are situated the premises on which disease has been confirmed, followed by the postal address and date of outbreak.

Anthrax

Angus. Whanland Farm, Farnell, Brechin (Mar. 18).
Ches. The Laurels, New Hall, Nantwich (Mar. 18).
Glas. Laigh Cleughearn Farm, East Kilbride (Mar. 17).

Atrophic Rhinitis

Norfolk. Poplar Farm, Waxham (Mar. 18).

Foot-and-mouth Disease

Surrey. Merrist Wood Estates, Worplesdon, Guildford (Mar. 20).

Fowl Pest

Ches. Horse Shoe Inn, Astbury, Congleton (Mar. 17).
Herts. 31, Garden Walk, Royston (Mar. 17).
Kent. Brook Farm, North Beech, Edenbridge (Mar. 18).
Lancs. Natby Hall Farm, Garstang, Preston (Mar. 17); Brook House Farm, Bretherton, Preston (Mar. 19); Back Lane Farm, Sowerby, St. Michaels, Preston (Mar. 20).
Yorks. Low Court Farm, Soyland, Ripponden, Halifax (Mar. 18); Moorcock Inn, Norland, Sowerby Bridge (Mar. 19).

Swine Fever

Anglesey. Ynys Bach, Llanerchymedd (Mar. 20).
Flints. Cwbyr Far, Rhuddlan, Rhyl; Cwbyr Ucha, Rhuddlan, Rhyr (Mar. 17).
Glos. Greystones, Siston Lane, Webbs Heath, Warmley, Bristol (Mar. 17).
Kent. Piggeries, Scrubbs Farm Lower Gravel Road, Bromley (Mar. 17).
Leics. Start Farm, Burbage, Hinckley (Mar. 19).
Middx. Brockley Cottage, Pipers Green Lane, Edgware (Mar. 17).
Norfolk. The Limes, Fersfield, Diss (Mar. 19).
Northants. Duchy Farm, Chelveston, Wellingborough (Mar. 19).
Somerset. The Prince of Waterloo Inn, Winford (Mar. 19); Shiplate Hill, Bleadon, Weston-super-Mare (Mar. 20).
Sussex. Blaines Allotments, Battle (Mar. 19).
Worcs. Bosworth Farm, Newland, Malvern (Mar. 19).
Yorks. Moor Lyn, North Lane, Huntingdon (Mar. 18); Stockton Cottage Farm, Towthorpe Lane, Huntingdon (Mar. 19).

Letters to the Editor

SCIENTIFIC

Preliminary Note on the Pathology of Canine Neo-natal Mortality

Sir,—From several hundreds of *post-mortem* examinations conducted on puppies with a history of death following the so-called "fading" syndrome, it is possible to state that the following may be regarded as typical of the macroscopic lesions encountered.

Evidence of anaemia; submaxillary and retro-pharyngeal lymphadenopathy (reddening, usually also enlargement); thyroid adenopathy (red discoloration, sometimes also enlargement); areas of fleshy, purplish discoloration and non-expansion of the lungs; a "sticky," injected appearance of the epicardium; variable changes in the liver, including often icteric pigmentation, but more constantly, perhaps, dark, purplish discoloration; variable gastro-enteritis with haemorrhagic tendency, which when present is accompanied by mesenteric lymphadenopathy. There is very constantly a marked, bright red discoloration of the nasal mucosa. The bone-marrow appears more extensive, more fluid, and of a darker red colour than normal. Changes may be seen in other organs, including the thymus, internal lymph glands, and kidneys. Changes sometimes occur in the periostea of various parts of the skeleton. I have tried to be brief and this list is not intended to be exhaustive.

Microscopically, the following are some of the more striking changes: morphological evidence of anaemia (*viz.* a greater degree than normal for the newborn of this species—and often extremely pronounced—of anisocytosis, polychromasia, and erythroblastosis. Evidence of reticulo-endotheliosis (circulating desquamated R.E. cells, often with their transitions to monocytes), neutropenia, and increase of eosinophils can usually be seen in the bloodsmear. The bone-marrow shows a picture of aplastic anaemia, it is sometimes impossible to find normoblasts or erythroblasts even on searching, and often deficiency of neutrophil myelocytes and proliferation of pigment-containing R.E. elements is noted. In the liver, as well as the other organs, pronounced extramedullary haemopoiesis (especially erythroblastosis, much above the normal degree at this age) is seen, and there is often evidence of a stasis icterus (prominent bilirubin casts in the bile capillaries). The thyroid shows changes of a necrobiotic-desquamative nature with stainable colloid tending markedly to disappear from the acini. In the enlarged thyroid (which is less often encountered) hyperplastic changes (believed to be a sequel to the above mentioned damage) can be seen, of the nature of a diffuse parenchymatous goitre. The lungs, the affected lymph nodes, and the spleen show what might be described as a pigmentary reticulo-endotheliosis. The stomach and bowel, when affected, show catarrhal-infiltrative changes with tendency to haemorrhage. The nasal mucosa shows hyperaemia, oedema, and other possible changes.

In these subjects, it is possible by patient searching to demonstrate sparse, small, intra-erythrocytic bodies composed of chromatin and cytoplasm, having the appearance of a protozoan of Babesiella or Theileria type (small, signet-ring forms, bacillary forms with bipolar or unipolar distribution of their chromatin, oval forms, sometimes larger pyriform types which occasionally have approached the size of a Babesia). These bodies have not been confused by one with Howell-Jolly bodies, superimposed platelets, or the dozens of artefacts that can puzzle the incautious beginner in bloodsmear examination and which appearances have been explained by the writer and others more competent in haematological atlases. Suspected bodies may also be seen in leucocytes, *viz.* monocytes, but often are difficult to assess.

In the internal organs, a variety of bodies are being studied with suspicion as possible phases of the parasite mentioned. In the liver, bodies are often seen within the cytoplasm of the hepatic cells tending to be regularly rounded, sharply outlined, within rather impressively constant size range, which have been shown microchemically to contain DNA as well as to give the "Romanovsky effect" with the usual blood-stains. Their occurrence in non-phagocytosing cells of this nature, possessing intact nuclei of their own, has made it very difficult even to suggest that these chromatic bodies could be of somatic origin. Similar bodies are often seen in renal epithelium.

Still other bodies suspected as being possible forms of this parasite are being observed. In the bowel, as well as at times even in the liver (but not in the hepatic cells), in other organs including the reacting lymph glands, even in the thymus and in the kidney still other bodies are being observed composed of a chromatic nuclei with distinct cytoplasmic envelop, often with an appearance of "budding" of the nuclei which conceivably may suggest a form of chromatin reduction preparatory to gametogony. Some of these forms are somewhat reminiscent of Coccidia, but in general much smaller. Further, suspicion has occurred of possible schizonts, mostly seen in cells of R.E. type, but frankly difficult to assess and to distinguish from possible somatic cell karyorrhexis. Lastly, attention is being paid to slender, crescentic, merozoite-like bodies, seen more especially in intestinal crypts and in the uterine glands.

The finding of the first-mentioned forms convinced me that one had to deal with a protozoan infection, whatever the relationship to the other forms mentioned. When these intra-erythrocytic forms were first encountered at Kennett, in older puppies or adult dogs, the association of piroplasm-like protozoans with anaemic changes led me to consider the possibility of *B. canis* infection (other regular protozoan pathogens being ruled out by the morphology). It soon became apparent, however, that in general, these forms were incompatible in over-all size range with Babesia, and it also became apparent, first that no particular suspicion of arthropod vectors seemed to

be aroused by the circumstances; and finally, that puppies were being born with this infection.

It seems inescapable that this parasite is in fact passing across the placenta; and (for what it is worth, since the infection appears to be widespread) where the dams of fading puppies have been critically examined it has been possible to establish the existence of anaemia and raised serum-bilirubin in these bitches, and in fact, if one has the patience, to demonstrate the intra-erythrocytic forms.

The occurrence of a suspected phase of this parasite in the liver raised the question of the possibility of its classification as a Hepatozoon sp. The question is involved, the evidence incomplete, and it is at present being suggested that protozoan infection of neo-natal puppies might be non-committally referred to as "congenital protozoonosis," pending classification by specialists in protozoology. One or two concluding remarks may be offered.

The severe changes so often seen in the thyroid have made the probable pathological physiology of "fading" a great deal clearer to me than it was previously.

The profound changes seen in the bone-marrow also might go far to explain the likelihood of secondary bacterial infections supervening in this state of neutropenia, accompanying the anaemia of the fading puppy. Such bacterial infection, although it has occurred in the present series of cases, has only been detected in a minority of cases and it is my personal opinion that it is not an essential part of the "fading puppy" syndrome.

It is intended to publish a note on this aspect in collaboration with Dr. M. E. Davies, formerly of this Centre.

It is also hoped, very shortly, to publish a note dealing with the problems of this infection in older puppies and adult dogs.

The grave pathological changes seen in the typical "fading" puppy led me to remark that prevention of this condition might be better than cure. Nevertheless, colleagues are attempting treatment of the newborn as well as treatment of suspected infected bitches. If treatment of newborn puppies should be attempted, I might mention two points in addition to possible specific chemotherapy. They are these: that treatment of the thyroid deficiency should not be neglected, and that chemotherapy is not at present intended to exclude the use of gamma globulin, which has gained considerable favour, probably deservedly, although its mode of action might be less specific than we are inclined to think.

Yours faithfully,
CECIL JACKSON.

Canine Health Centre,
Animal Health Trust,
Kennett.

March 21st, 1958.

A Field Method for Measuring Blood Cholinesterase of Animals

Sir,—The first sign of poisoning with an organic phosphorus compound is a fall in the blood cholinesterase level. However, animals can steadily lose over 90 per cent. of their blood cholinesterase without showing clinical symptoms. For this reason periodic measurements of blood cholinesterase is a safeguard in the prevention of losses through over-exposure or repeated exposure to organo-phosphorus parasiticides. Unfortunately many field workers are denied this diagnostic aid because the methods for estimating the blood cholinesterase need comparatively elaborate laboratory facilities.

The same problem applied in medical toxicology until Edson (1955) developed a simple field test for human blood using a Lovibond Comparator. The basis of this method relies upon the production of acetic acid by the interaction between acetylcholine and the cholinesterase in the blood sample. An aqueous solution of bromothymol blue is used as the indicator. The blood sample and reagents are mixed, and the resultant colour change is measured and timed against calibrated discs in the Comparator. The advantages of this colormetric method are that the equipment required is easily carried, simple to operate, and only minute quantities of blood (0.01 ml.) are required.

Human blood contains a much higher concentration of cholinesterase than obtains in the lower animals. It therefore takes longer to produce sufficient acetic acid to induce the colour change used in the Lovibond Comparator technique. This period of time can be reduced by increasing the amount of blood, although too much blood makes it difficult to match the colours against the calibrated discs in the Comparator.

We have now adapted the Lovibond Comparator technique for use on animals. The results in over 1,000 tests, on normal and treated animals, were checked with a titrimetric method and proved reasonably reliable. No alteration is required to the equipment described by Edson (1958), and made by Messrs. Tintometer Ltd., Waterloo Road, Salisbury, Wilts.

The cholinesterase content of cattle, sheep, dogs, mice, and guinea-pigs has been assessed. The blood is drawn into a pipette after collection from the ear by pricking a vein with a needle, except in the case of mice when the tail is used. Although 0.01 ml. of blood is adequate for guinea-pigs and mice, double this amount, *i.e.*, 0.02 ml., is better in the case of cattle, dogs, and sheep. The blood is immediately transferred to a tube and mixed with 0.5 ml. of the bromothymol blue solution. The reaction is initiated by the addition of 0.5 ml. acetylcholine and the time at which the acetylcholine is added must therefore be noted. The mixture is transferred to the cell of the Comparator at the times given below and the percentage conversion is noted. An alternative method is to compare the conversion period of the test bloods with blood taken at the same time from a normal animal. The advantage of this method is that it overcomes variations due to local climatic conditions.

Cattle	...	80	minutes	using	0.02	ml.	of blood
Dogs	...	40	"	"	"	"	"
Sheep	...	120	"	"	"	"	"
Mice	...	20	"	"	0.01	"	"
Guinea-pigs		80	"	"	"	"	"

A conversion exceeding 75 per cent. on the Comparator scale, within the stated time, shows that the blood is normal. Although an interpretation of cholinesterase depression is influenced by the nature of the organic phosphorus compound used, the treatment employed and the age and health of the animal, we use the following criteria. Values of 50 to 75 per cent. suggest a moderate depression, which in our experience can be tolerated by animals for long periods without any ill effects. The range 35 to 50 per cent. does not appear to be associated with any clinical symptoms but suggests caution in repeated treatments with organic phosphorus compounds. Values below 35 per cent. indicate a severe exposure, such animals should not be exercised vigorously, nor exposed to further treatment until their blood cholinesterase level has returned to normal, or well above 50 per cent., where further treatment is essential.

We have so far been unable to obtain satisfactory results with goats and rats.

Yours faithfully,
D. W. JOLLY.
B. D. RATCLIFFE.

The Cooper Technical Bureau,
Berkhamsted,
Herts.
March 18th, 1958.

References

EDSON, E. F. (1955). *B.M.J.* **1**. 1,218.
———. (1958). *World Crops*. February.

GENERAL

Prolapse of the Rectum in the Pig

Sir,—May I suggest that the obstructive stenosis which often follows simple amputation of the prolapsed rectum in the pig is due to partial obliteration of the lumen of the rectum during operation?

This can be avoided by using a suitable round to keep the rectum dilated whilst the overlapping sutures are inserted. I have had great success using an ordinary candle which is held in place by a 3-inch straight triangular needle inserted vertically and transfixing the prolapse.

The sutures are inserted about ¼ inch from the anal ring using No. 1 catgut and a curved, round-bodied needle. The prolapse is then excised about ⅛th inch from the line of sutures, and the candle, with prolapse attached, is withdrawn. I have not found it necessary to insert a retention suture round the anus afterwards.

The operation can be carried out quite satisfactorily under local anaesthesia, and takes only 10 to 15 minutes.

I only amputate those prolapses which are severely lacerated, the rest being replaced in the manner described by Mr. Strang.

Yours faithfully,
A. H. PILL.

95, Damers Road,
Dorchester,
Dorset.
March 17th, 1958.

Muscle Relaxants

Sir,—The Protection of Animals (Anaesthetics) Act, 1944, includes the following: "... that any operation which is performed on any kind of animal without anaesthetic so administered as to prevent the animal feeling pain throughout the operation shall be deemed to be performed without due care and humanity within the meaning of the Protection of Animals Act, 1911."

As has been implied earlier in this correspondence, when operating on an animal deprived of all muscular movement we have, in practice, no means of knowing whether we are complying with this law.

The effect of succinyl choline is to deprive an animal of all muscular movement. Surely, then, the use of this drug during surgical procedures (excluding those exempted in the first schedule of the Act) must be a contravention of existing legislation?

Yours faithfully,
C. A. FINN.

53, The Fairway,
Gravesend,
Kent.
March 22nd, 1958.

Measurement of Horses

Sir,—A veterinary surgeon's certificate of the height of a horse is frequently requested, particularly from those who help to operate the Joint Measurement Scheme of the British Show Hack and Cob Association. The object of these certificates is usually to establish that the animal in question is below a certain height, to establish eligibility for certain show or jumping classes.

On the principle that "a good big one will always beat a good little one," it is obviously in the owner's interest to have an animal which is as near to the upper limit as possible; but half an inch too much could depreciate the value of a top-class animal by hundreds of pounds.

The height of a horse is traditionally measured at the highest point of the withers.

The reason for writing this letter is to suggest that the height of a horse at the withers is not a constant figure.

The equine thorax is suspended in the elastic cradle of the attachment muscles of the fore limbs. There is also the variable angle of the fetlock joint.

There are some horses which, when completely relaxed, measure at least one inch less than if they were excited or even alert.

A heavy weight on a horse's back for a continuous half hour prior to measurement, can decrease the height even below the "relaxed" height.

Feet when thoroughly washed down can give another half inch. If there is the usual "¼ an inch for shoes" allowance, another ⅜ inch can be gained by paper-thin shoes.

Height certificates for animals up to six years are usually required annually. Over six years old, life certificates may be accepted.

Should there be an objection at a show to the certificated height of an animal, it will be re-measured by (veterinary) referees.

Should this animal be one which was "helped down" to the required height by any of the above mentioned advantages, should it now have overgrown feet, thick shoes, be fit, and/or excited, with muscles tensed, the height measurement will not be that on the certificate.

The veterinary surgeon who gave the original certificate may look at the least foolish and at the worst, could possibly be accused of giving a certificate false in a material particular, unless it is officially recognised and admitted that the height of a horse as measured at the withers is not constant.

Yours faithfully,
D. V. SINCLAIR.

23, Kirkgate,
Thirsk,
Yorks.
March 10th, 1958.

An Author's Complaint

Sir,—I never thought that I would find myself joining the ranks of the critics of your scrutineers. However, upon opening my copy of this week's RECORD I find a report of the treatment of "Feline Enteritis with Cortisone," and I am delighted to see other people have found cortisone of real value in this peculiar syndrome. The article does not incense me, but I am hopping mad with your scrutineers because I submitted a very similar report months ago which was returned with the comment that the scrutineers did not consider that adequate diagnosis had been achieved. I cannot conceive what more they should want other than that the terrier concerned was suffering from a "feline enteritis" like disease which failed to respond to any normal treatment but did respond immediately and spectacularly to deltacortril. Incidentally, since submitting my report I have had two further similar cases which have given equally spectacular response to deltacortril brand prednisolone. I have not reported these either because I feel that it is a waste of time to prepare for publication articles which will be turned down by the scrutineers.

Whilst I am on the subject, and before my temper cools down, I wish to make a further complaint about submitting an interim report about a Scottish Terrier that gained nation-wide notoriety over a blood transfusion! This dog is suffering from lymphatic leukaemia, or a disease very closely approximating to it, and has made a fantastic recovery from being virtually dead on its feet and being now a very lively and active dog.

In this case I was asked by the Editor to submit an interim report which I did, and which again was turned down by the scrutineers on the ground that sufficient time had not elapsed to assess the true value of the case. I am amazed at the short-sighted view of the scrutineers, and now feel very disinclined to submit any more articles for publication.

If the foregoing is the experience of many practitioners, as I believe it is, then it is a very sad loss to the profession as a whole, because the experiences of individuals in practice can be of inestimable value to others, and a great deal of valuable information must be lost to us. It is most discouraging to be asked on the one hand by the Editor to submit clinical articles and then when we do, to have them turned down and frankly disbelieved by the scrutineers.

Yours faithfully,
R. H. CLOVER.

The Grange,
Osborn Road,
Fareham.
March 22nd, 1958.

Mutation of the Bovine Foot

Sir,—I was interested to read Mr. Penny's clinical communication in THE RECORD of March 15th on the subject of a steer with only a single claw on each front foot. About 4 years ago I encountered a similar condition in 3 Friesian calves born on the same farm, although in this case all four feet of each calf bore only one claw. Two of the calves were dead at birth and the other survived only 2 days. The mothers, which were first calvers, had been purchased together with the bull a year previously from a neighbouring farm and it was discovered that they were all by the same sire. As other calves by the same bull out of home-bred heifers were normal it was considered that the mutation was due to too close in-breeding. Subsequent calves from these heifers by a different bull were normal.

It would be interesting to know if a similar history applies in the case quoted by Mr. Penny.

Yours faithfully,
E. G. BARNES.

Dorset Cottage,
Norwich Road,
Dereham,
Norfolk.
March 22nd, 1958.

Castration by the Rubber-ring Method

Sir,—The recent article and ensuing correspondence on this subject in your issues of February 1st, 8th, and 22nd, has been, in the main, so unfairly critical and uninformed that I feel that some explanation of this essentially simple operation is warranted.

The "elastrator" rubber ring method of castrating calves and lambs is used in many overseas countries with complete success. My own experience and observation of it dates from 1952 and has been obtained in New Zealand and Southern Rhodesia, where in both countries it is widely adopted as the method of choice. When dealing with large numbers of animals both the crushing (Burdizzo) and open (knife) methods are too laborious. The open method cannot in any case be used in tropical countries because of flies, ticks, and screw worm.

The principle of the rubber ring method is to sever completely by ligature the lower half of the scrotum (containing the testicles) from the upper half, by means of a small and very tight rubber ring. All circulation of blood across this elastic ligature is stopped and a dry necrosis of the lower half of the

scrotum results, with its shrivelling up and separation. It follows that the efficiency of the ligature depends on the softness or otherwise of the scrotal tissue to which it is applied.

In practice this means that only very young animals must be subjected to "elastration." It is always my definite instruction to operators that *calves must be under 7 days old and lambs under* 10 *days old*. When so applied this method is 100 per cent. successful, causes no discomfort, animals are not checked in growth, and the "elastrated" lower half of the scrotum drops off within a fortnight leaving a small scar which rapidly disappears. This method is quick, simple, clean, and bloodless, and I consider it to be the least painful of the recognised methods of castration.

To anyone familiar with the correct use of "elastrator" castration in the field the article by Messrs. Fenton, Elliot, and Campbell in your issue of February 1st must appear quite fantastic. In this experiment calves "were castrated when about 7 *weeks old*" (my italics). The detailed account of the unfortunate animals' sufferings serves only too clearly to emphasise what will happen when "elastrator" castration is wrongly used. The conclusions reached in this article, insofar as they appertain to the "elastrator" method, are valueless.

I do not recommend the rubber ring for the removal of lambs' tails because the tail at the usual operating time is too hard for effective action of the ligature. Mr. K. C. Towers (in your issue of February 8th) implies that its use within 48 hours of birth is satisfactory. However, in farming practice it is inconvenient to collect lambs except once every 7 to 10 days during the lambing season, for castration and docking. At this age I advise "elastrator" castration and the hot iron for docking. Rubber rings used on lambs' tails are not always effective in practice, and are often associated with outbreaks of tetanus and arthritis in lambs.

Yours faithfully,
R. S. DUGDALE.

P.O. Box 572,
Bulawayo,
Southern Rhodesia.
March 21st, 1958.

Metabolic Disorders in Hill Sheep

Sir,—We are grateful to Messrs. White and Jarrett for the comments they make on our article on metabolic diseases in hill sheep, recently published in THE VETERINARY RECORD, and are sorry that we have not replied before this to the questions raised by them. We have been busily engaged during the past month in dealing with disorders of this type, and we have had little time to devote to a reply.

In reply to Mr. Jarrett, we believe, with him, that transit plays a vital part in the onset of metabolic disorders in both cattle and sheep. A number of reports of "transit tetany" have appeared in the literature, and we are sure that many more, similar to those mentioned by Mr. Jarrett, have been encountered by veterinary surgeons, but not reported. We would agree, too, that in the two particular incidents reported by us, the transit factor was more important than the change in diet in precipitating the onset of of symptoms, but we do not believe that changes in diet are unrelated to the cause of metabolic disorders in general.

In reply to Mr. J. B. White, the pasture into which the hill ewes, mentioned in the first incident, were put had not been dressed with nitrogen; the soil was "in good heart" and although bare, having carried 200 lowland ewes during the preceding 3 weeks, it is possible that it was in an active stage of growth. On the other hand, some of the pastures mentioned in the second incident had received a dressing of "nitrochalk" before the ewes were turned onto them.

The original seed mixtures sown in the fields involved in both incidents might vary slightly, but would resemble the standard sort of mixture which is widely used in stock-rearing areas where sheep play an important part in the rural economy. The kind of mixture would be something like the following:—

	lb. per acre
Perennial Rye Grass ...	12 to 14
Cocksfoot	4 to 5
Timothy	4 to 5
W. W. Clover	1
N. Z. W. Clover	1

The botanical composition of the fields would vary somewhat according to age, management, etc., as various species of Agrostis and "weeds" invaded the sward and replaced some of the sown species. The proportion of white clover present would depend to some extent upon manurial treatment. Much more phosphate is used on the pastures of Mid-Wales than nitrogen, so encouraging the growth of clovers.

It is well recognised that weather conditions play an important part in the incidence of pregnancy toxaemia. We, like Mr. White, have wondered about the inter-relationship of elevation and weather changes in the cause of some of the other metabolic diseases of sheep.

Finally, the ewes described in the first incident were close to lambing—lambs were born to a number the day after the treated ewes were injected with calcium and magnesium. The ewes in the second incident described were not so close to lambing as the move was made about a fortnight before lambing was due to commence.

Yours faithfully,
L. E. HUGHES.
G. F. KERSHAW.

Veterinary Investigation Centre,
Y Buarth,
Aberystwyth.
March 24th, 1958.

ERRATUM

We are asked by one of the authors to state that in the paper "Blood Volume Determinations in Horses Using Radioactive Phosphorus" (*Vet. Rec.* **70**. 216) the local anaesthetic used was incorrectly named. It was, in fact, Ravocaine, a product of Messrs. Bayer Ltd., having the following composition: ravocaine 0.4 per cent. w/v, novocain 2.0 per cent. w/v, cobefrin 1 : 10,000.